

# NETOPIA® FIRMWARE USER GUIDE

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NETOPIA® 4000-SERIES EQUIPMENT

NETOPIA FIRMWARE VERSION 5.4



netopia®

BROADBAND WITHOUT BOUNDARIES™

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## **Part Number**

Netopia part number 6161184-00-01

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# Chapter 1

## Introduction

This *Firmware User Guide* covers the advanced features of the Netopia 4000-Series Router and IAD families.

Your Netopia equipment offers advanced configuration features in addition to Easy Setup. The advanced feature screens are accessed through the Main Menu of the console configuration screen. This *Firmware User Guide* documents the advanced features, including advanced testing, security, monitoring, and configuration features. This *Firmware User Guide* should be used as a companion to the Easy Setup configuration instructions in the Netopia Router *Getting Started* guide or the applicable *User's Reference Guide*. You should read the *Getting Started* guide before reading this *Firmware User Guide*.

---

**Note:** This *Guide* also includes descriptions of new features and changes to the functionality of the firmware for the current release, Netopia Firmware Version 5.4. Such descriptions supersede the descriptions of the corresponding features given in the original *User's Reference Guide*, if any, accompanying your product.

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## What's New in Netopia Firmware Version 5.4

New in Netopia Firmware Version 5.4 are the following features:

- Multiple Data Link Encapsulation support on ATM-based WAN interfaces  
See [“Multiple Data Link Encapsulation Settings”](#) on page 2-25.
- Stateful Inspection Firewall  
See [“Stateful Inspection firewall”](#) on page 2-37.
- IP Passthrough support  
See [“IP Passthrough”](#) on page 3-27.
- Universal Plug-and-Play support (UPnP™)  
See [“UPnP Support”](#) on page 10-2.

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## Console-based Management

Console-based management is a fast menu-driven interface for the capabilities built into the Netopia Firmware Version 5.4. Console-based management provides access to a wide variety of features that the router supports. You can customize these features for your individual setup. This chapter describes how to access the console-based management screens.

This section covers the following topics:

- “Netopia Console Menus” on page 1-2
- “Netopia Models” on page 1-3
- “Connecting through a Telnet Session” on page 1-4
- “Connecting a Console Cable to your Equipment” on page 1-5
- “Navigating through the Console Screens” on page 1-7

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## Netopia Console Menus

Console-based management screens contain the main entry points to the Netopia Firmware Version 5.4 configuration and monitoring features. The entry points are displayed in the Main Menu shown below:

### Netopia Data Router

```

Netopia Router

Easy Setup...
WAN Configuration...
System Configuration...
Utilities & Diagnostics...
Statistics & Logs...
Quick Menus...
Quick View...

Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

### Netopia IAD

```

Netopia IAD

Easy Setup...
WAN Configuration...
System Configuration...
Voice Configuration...
Utilities & Diagnostics...
Statistics & Logs...
Quick Menus...
Quick View...

Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

- The **Easy Setup** menus display and permit changing the values contained in the default connection profile. You can use Easy Setup to initially configure the router directly through a console session.

Easy Setup menus contain up to five descendant screens for viewing or altering these values. The number of screens depends on whether you have optional features installed.

The *Getting Started* manual describes the Easy Setup menus to get you up and running quickly.

- The **WAN Configuration** menu displays and permits changing your connection profile(s), Virtual Private Networks (VPNs) and default profile, creating or deleting additional connection profiles, and configuring or

reconfiguring the manner in which you may be using the router to connect to more than one service provider or remote site. See “WAN Configuration,” beginning on page 2-1. See also Chapter 4, “Virtual Private Networks (VPNs).”

- The **System Configuration** menus display and permit changing:
  - IP Setup
  - Network Address Translation (NAT)
  - Console Configuration
  - Upgrade Feature Set
  - Filter Sets
  - Stateful Inspection
  - SNMP (Simple Network Management Protocol)
  - Change Device to a Bridge
  - IP Address Serving
  - Date and Time
  - Security
  - Logging

See “System Configuration Screens,” beginning on page 2-35.

- For IADs, the **Voice Configuration** menus provide the tools for configuring the voice telephone features available in Netopia Firmware Version 5.4. See Chapter 8, “Voice Configuration.”
- The **Utilities & Diagnostics** menus provide a selection of seven tools for monitoring and diagnosing the router’s behavior, as well as for updating the firmware and rebooting the system. See Chapter 11, “Utilities and Diagnostics.”
- The **Statistics & Logs** menus display nine sets of tables and device logs that show information about your router, your network, and their history. See “Statistics & Logs,” beginning on page 9-4.
- The **Quick Menu** screen is a shortcut entry point to the most commonly used configuration menus that are accessed through the other menu entry points.
- The **Quick View** menu displays at a glance current real-time operating information about your router. See “Quick View Status Overview” on page 9-1.

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## Netopia Models

This *Firmware User Guide* covers all of the Netopia 4000-Series Router and IAD models. However some information in this guide will only apply to a specific model.

### Screen differences

Because different Netopia 4000-Series models offer many different features and interfaces, the options shown on some screens in this *Firmware User Guide* may not appear on your own particular model’s console screen.

These differences are noted throughout the manual.

---

## Connecting through a Telnet Session

Features of the Netopia Firmware Version 5.4 can be configured through the console screens.

Before you can access the console screens through Telnet, you must have:

- A network connection locally to the router or IP access to the router.

---

**Note:** Alternatively, you *may* have a direct serial console cable connection using a provided console cable and the Console port on the back of the router. Some models do not have a console port. For more information on attaching the console cable, see [“Connecting a Console Cable to your Equipment” on page 1-5](#).

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- Telnet software installed on the computer you will use to configure the router

## Configuring Telnet software

If you are configuring your device using a Telnet session, your computer must be running a Telnet software program.

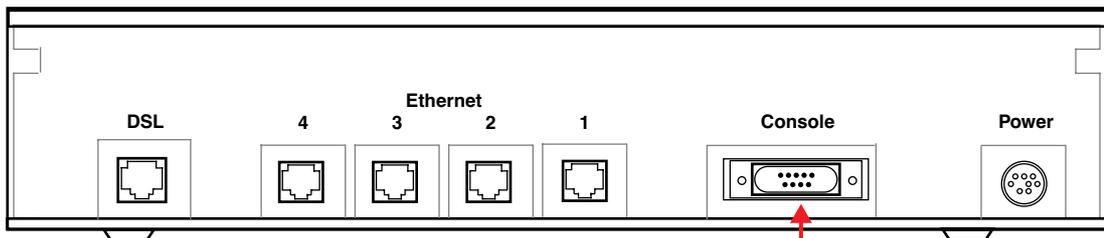
- If you connect a PC with Microsoft Windows, you can use a Windows Telnet application or simply run Telnet from the Start menu.
- If you connect a Macintosh computer, you can use the NCSA Telnet program supplied on the Netopia CD. You install NCSA Telnet by simply dragging the application from the CD to your hard disk. Mac OS X users can run Telnet in the Terminal application, found in the Mac OS X Utilities folder.

## Connecting a Console Cable to your Equipment

Many Netopia models include a serial console port labeled “Console” on the back panel. You can perform all of the system configuration activities for your Netopia equipment through a local serial console connection, if available, using terminal emulation software, such as HyperTerminal provided with Windows 95, 98, 2000, or NT on the PC, or ZTerm, included on the Netopia CD, for Macintosh computers.

You attach the Netopia device to either a PC or Macintosh computer via the serial port on the computer. (On a Macintosh computer, the serial port is called the Modem port or Printer port. Since Macintosh computers have different serial bus connectors, you may need a USB-to-DB-9 or USB-to-serial adapter. These are available from a variety of third-party manufacturers.) This connection lets you use the computer to configure and monitor the Router via the console screens.

*Example back panel*



**Console connection port  
DB-9 (male)**

To connect to your computer for serial console communication, use a console cable appropriate to your platform:

- A DB-9 connector end attaches to a PC.
- A DB-9 end of the Console cable attaches to the Console port.
- If you connect a PC with Microsoft Windows 95, 98, 2000, or NT, you can use the HyperTerminal application bundled with the operating system.
- If you connect a Macintosh computer, you can use the ZTerm terminal emulation program on the supplied Netopia CD.

## 1-6 Firmware User Guide

Launch your terminal emulation software and configure the communications software for the values shown in the table below. These are the default communication parameters that the Netopia Firmware Version 5.4 uses.

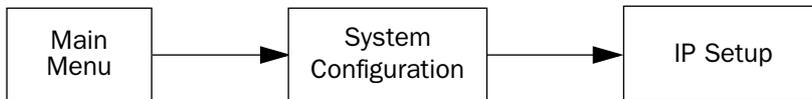
Parameter	Suggested Value
Terminal type	<b>PC:</b> ANSI-BBS <b>Mac:</b> ANSI, VT-100, or VT-200
Data bits	8
Parity	None
Stop bits	1
Speed	9600 - 57600 bits per second
Flow Control	None
<b>Note:</b> The router firmware contains an autobaud detection feature. If you are at any screen on the serial console, you can change your baud rate and press Return (HyperTerminal for the PC requires a disconnect). The new baud rate is displayed at the bottom of the screen.	

## Navigating through the Console Screens

Use your keyboard to navigate the Netopia Firmware Version 5.4's configuration screens, enter and edit information, and make choices. The following table lists the keys to use to navigate through the console screens.

To...	Use These Keys...
Move through selectable items in a screen or pop-up menu	Up, Down, Left, and Right Arrow
Set a change to a selected item or open a pop-up menu of options for a selected item like entering an upgrade key	Return or Enter
Change a toggle value (Yes/No, On/Off)	Tab
Restore an entry or toggle value to its previous value	Esc
Move one item up	Up arrow or Control + K
Move one item down	Down arrow or Control + O
Display a dump of the device event log	Control + E
Display a dump of the WAN event log	Control + F
Refresh the screen	Control + L

To help you find your way to particular screens, some sections in this guide begin with a graphical path guide similar to the following example:



This particular path guide shows how to get to the Network Protocols Setup screens. The path guide represents these steps:

1. Beginning in the Main Menu, select **System Configuration** and press Return. The System Configuration screen appears.
2. Select **IP Setup** and press Return. The IP Setup screen appears.

To go back in this sequence of screens, use the Escape key.



## Chapter 2

# WAN and System Configuration

This chapter describes how to use the console-based management screens to access and configure advanced features of your equipment. You can customize these features for your individual setup. These menus provide a powerful method for experienced users to set up their router's connection profiles and system configuration.

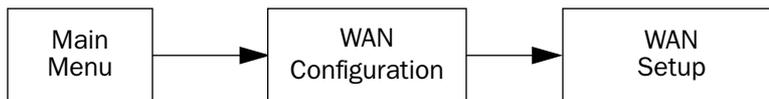
This section covers the following topics:

- “WAN Configuration” on page 2-1
  - “ADSL Line Configuration screen” on page 2-2
  - “SDSL/IDSL Configuration screen” on page 2-3
  - “G.SHDSL Line Configuration screen” on page 2-6
  - “T1 Line Configuration screen” on page 2-7
- “Frame Relay Configuration” on page 2-9
- “Multiple ATM Permanent Virtual Circuits” on page 2-16
- “Creating a New Connection Profile” on page 2-24
- “The Default Profile” on page 2-28
- “Scheduled Connections” on page 2-29
- “System Configuration Screens” on page 2-35

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## WAN Configuration

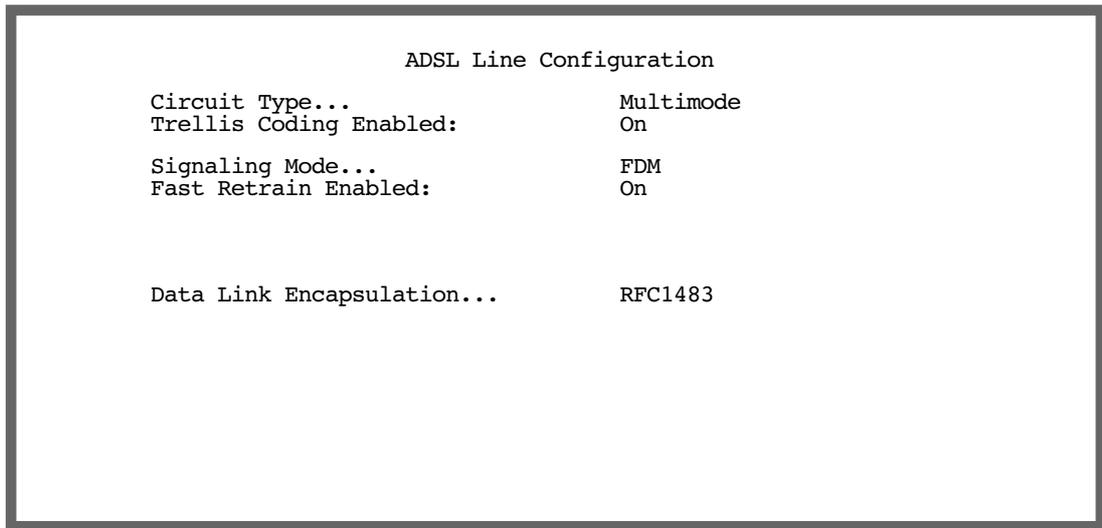
To configure your Wide Area Network (WAN) connection, navigate to the WAN Configuration screen from the Main Menu and select **WAN (Wide Area Network) Setup**.



The Line Configuration screen appears. The Line Configuration screen will be appropriate to the type of WAN interface supported by your particular router model.

## ADSL Line Configuration screen

The ADSL Line Configuration screen is shown below:



```

                                ADSL Line Configuration

Circuit Type...                Multimode
Trellis Coding Enabled:        On

Signaling Mode...              FDM
Fast Retrain Enabled:          On

Data Link Encapsulation...      RFC1483

```

1. Select **Circuit Type** and from the pop-up menu choose the type of circuit to which you will be connecting: Multimode, T1.413, G.dmt/G.lite, or ADI.
2. Select **Trellis Coding Enabled**. Toggle it to On (the default) or Off.
3. Select **Signaling Mode** and choose Echo Cancellation or FDM (the default).
4. If you selected Multimode Circuit Type, the **Fast Retrain Enabled** field appears. Toggle it to On (the default) or Off.
5. Select **Data Link Encapsulation** and press Return. The pop-up menu will offer you the choice of PPP or RFC1483.
6. Press Escape to return to the WAN Configuration screen.

For multiple permanent virtual circuit (PVC) configurations, see [“Multiple ATM Permanent Virtual Circuits”](#) on page 2-16.

## SDSL/IDSL Configuration screen

The SDSL/IDSL Line Configuration screen is shown below:

```

SDSL Line Conf+-----+
|
| Line Type...          | SDSL-ATM
| Operation Mode...    | SDSL-HDLC
|                      | IDSL
|                      | IDSL-CM
|                      +-----+
|                      | 384
|
| Data Rate Mode...    |
| Data Rate...        |
|
|
|
| Data Link Encapsulation...  PPP
| PPP Mode...              VC Multiplexed
|
|
|
| Return/Enter to select <among/between> ...
| Enter Information supplied to you by your telephone company.

```

- Select a **Line Type** from the pull-down menu. You can choose **SDSL-ATM**, **SDSL-HDLC**, **IDSL**, or **IDSL-CM**. For IDSL connections, choose IDSL if your service provider uses most common central office equipment; choose IDSL-CM if your service provider uses Copper Mountain equipment. If you choose either IDSL type, the router must reboot and you will see a warning screen to confirm your choice.

IDSL configuration offers different options. See [“IDSL Line Configuration screen”](#) on page 2-5.
- The **Operation Mode** pull-down menu allows you to select the type of SDSL-ATM DSLAM to which you will be connecting: **Generic**, **Lucent**, **Nokia EOC Fast**, **Nokia Fixed**, **Paradyne**, **Nortel UE IMAS** or **Newbridge**.

```

SDSL Line Configuration
-----+-----+
Line Type...
Operation Mode...
Data Rate Mode...
Data Rate...
Data Link Encapsulation...
RFC1483 Mode...
Generic
Lucent
Nokia EOC Fast
Nokia Fixed
Paradyne
Nortel UE IMAS
Newbridge
RFC1483
Routed 1483

```

Some of these selections will reset the defaults for the remaining options in this screen. You will be challenged to confirm your choice. The SDSL-HDLC and IDSL Line Types do not offer these choices.

- The **Data Rate Mode** pull-down menu allows you to select either **Hunt** or **Locked** mode.
  - If you choose **Hunt**, the router will cycle through the speeds available and attempt to connect at the highest available speed. This hunt will take a few minutes. When a negotiated speed is determined, the router will remember that speed and use it as the starting point for the next time a connection is attempted.
  - If you choose **Locked**, the Data Rate you select in the next menu will always be used.
- The **Data Rate** pull-down menu allows you to select the data rate for your connection. This is usually assigned by your Service provider.
- Your **Data Link Encapsulation** may be either **PPP** or **RFC1483**, as assigned by your Service Provider.
  - If you are using PPP, the **PPP Mode** menu offers either **VC Multiplexed** or **LLC SNAP**.
  - If you are using RFC1483, the **RFC1483 Mode** menu offers either **Bridged 1483** or **Routed 1483**. Bridged 1483 displays a **PPP over Ethernet (PPPoE)** toggle item that can be toggled either **On** or **Off**.

## ISDL Line Configuration screen

The ISDL Line Configuration screen is shown below:

```

                                IDSL Line Configuration

Line Type...                      IDSL
Data Rate (kbps)...                144 (2B+D)

Data Link Encapsulation...        PPP

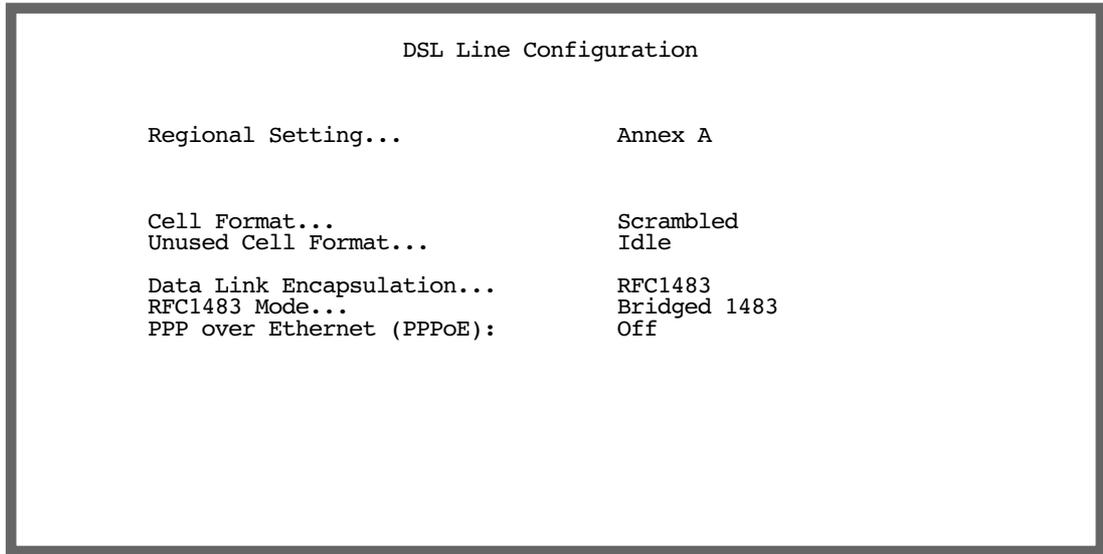
Return/Enter to select <among/between> ...
Enter information supplied to you by your ISDN phone company.

```

- For ISDL lines, the **Data Rate (kbps)** pull-down menu offers **64 (B1)**, **64 (B2)**, **128 (B1+B2)**, or **144 (2B+D)**.
- The **Data Link Encapsulation** pull-down menu offers **PPP**, **HDLC**, or **Frame Relay**.
  - If you are using Frame Relay, a **PPP over Frame Relay Enabled** option appears and allows you to toggle it either **On** or **Off**.
  - If you enable PPP over Frame Relay, the DLCI and LMI fields appear. The **DLCI** field is editable; the default is 16. The **LMI** pull-down menu offers the choices None, ANSI (Annex D), CCITT (Annex A), or LMI.

## G.SHDSL Line Configuration screen

The G.SHDSL Line Configuration screen is shown below:



Each access concentrator (DSLAM) has a different set of defaults and other parameters.

Your service provider should supply you with the appropriate information about the type and capabilities of the access concentrator equipment they use.

- Select **Regional Setting** and from the pop-up menu select either Annex A or Annex B. North American users select Annex A; non-North American users select Annex B.
- Select **Cell Format** and from the pop-up menu select either Scrambled (the default) or Unscrambled. This setting must match the format used by your service provider. Scrambled is the most common, so you probably do not need to change it unless your provider specifically tells you to do so.
- Select **Unused Cell Format** and from the pop-up menu select either Idle (the default) or Empty. This setting must match the format used by your service provider. Idle is the most common, so you probably do not need to change it unless your provider specifically tells you to do so.
- Select **Data Link Encapsulation** and from the pop-up menu choose your DLE.
  - If you selected RFC1483, the next pop-up menu **RFC1483 Mode** offers the choice of Bridged 1483 or Routed 1483. If you select Bridged 1483, a new option **PPP over Ethernet (PPPoE)** appears. You can then toggle PPPoE On or Off. Choosing Routed 1483 hides the PPPoE option.
  - If you selected PPP, the next pop-up menu **PPP Mode** offers the choice of VC Multiplexed or LLC SNAP.

## T1 Line Configuration screen

The T1 Line Configuration screen is shown below:

```

                                T1 Line Configuration

Operation Mode...                HDLC
Line Encoding...                 B8ZS
Framing Mode...                  ESF
Transmit ANSI PRMs:              No
AutoDetect DS0 Channels:         No
Number of DS0 Channels:          1
First DS0 Channel:               1

Buildout (-dB)...                0-0.6
Channel Data Rate...             Nx64k

Data Link Encapsulation...       Frame Relay
PPP over Frame Relay Enabled:     Off

Return/Enter goes to new screen.
Enter Information supplied to you by your telephone company.

```

- Select **Operation Mode** and press Return. From the pop-up menu, highlight the mode your telephone service provider uses: **HDLC** (Cisco), **CM-HDLC** (Copper Mountain), or **ATM**. The default setting is HDLC. Press Return.
- Select **Line Encoding** and press Return. From the pop-up menu, highlight the encoding your telephone service provider uses: **B8ZS** or **AMI**. The default setting is B8ZS. Press Return.
- Select **Framing Mode** and press Return. From the pop-up menu, highlight either **ESF** or **D4**, depending on the framing mode that your telephone service provider advises you to use. The default setting is ESF. Press Return.
- If you selected ESF framing mode, toggle **Transmit ANSI PRMs** either No (the default) or Yes. If you selected D4 framing mode, this option is not available.
- Select **AutoDetect DS0 Channels**. Netopia routers whose model number ends in “-T” may be able to use the auto detection feature. Toggle this item to Yes if your service provider uses equipment that supports DS0 channel auto detection. Otherwise accept the default No.
- Select **Number of DS0 Channels** and enter the number of DS0 channels that you and your telephone service provider have determined are necessary for your T1 line. The default setting for DS0 Channels is 1 (one). Press Return.

**Note:** Each DS0 channel represents a 56k or 64k increment in bandwidth. Selecting a number less than the maximum of 24 specifies a fractional T1 interface.

For fractional T1, you can also specify in the check box whether the DS0 channels are contiguous or alternating.

- Select **First DS0 Channel** and enter the number of the first active DS0 channel you will be using. The

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default setting is 1 (one). Press Return.

**Note:** You can change the First DS0 Channel number, which has a valid range from one to the maximum number minus the number of active channels. If the number of active DS0 channels is 24 (maximum), **First DS0 Channel** is hidden.

If you specify a number of DS0 channels less than the maximum, a Contiguous Channels item appears. For fractional-T1, you can specify whether the DS0 channels are contiguous or alternating by toggling **Contiguous Channels** to **Yes** or **No**.

- Select **Buildout (-dB)** and press Return. From the pop-up menu, highlight the line buildout, which is the transmit attenuation of the line that you will be using. The choices in the menu include **Auto**, **0-0.6**, **7.5**, **15.0**, **22.5**, and **None**. The default setting is 0-0.6. Press Return.  
If Automatic is chosen, the attenuation of the transmission will be set to match the receiving signal level.
- Select **Channel Data Rate** and highlight the data rate specified by your service provider. The channel data rate choices are **Nx56k** or **Nx64k**. The default is Nx64k. Press Return.
- Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are **PPP**, **HDLC** (Cisco), **RFC 1483**, and **Frame Relay**. The default setting is Frame Relay. Press Return.

The screen will offer different options depending on your selection.

### Frame Relay Options

```
T1 Line Configuration

Operation Mode...      Normal
Line Encoding...      B8ZS
Framing Mode...       ESF

Number of DS0 Channels: 1
First DS0 Channel:    1

Channel Data Rate...   Nx64k

Data Link Encapsulation... Frame Relay
PPP over Frame Relay Enabled: On
DLCI:                  16
LMI:                   None

TO MAIN MENU          NEXT SCREEN

Return/Enter takes you back to previous screen.
Enter Information supplied to you by your telephone company.
```

### PPP Options

```
T1 Line Configuration

Operation Mode...      Normal
Line Encoding...      B8ZS
Framing Mode...       ESF

Number of DS0 Channels: 1
First DS0 Channel:    1

Channel Data Rate...   Nx64k

Data Link Encapsulation... PPP
PPP Mode...            VC Multiplexed

TO MAIN MENU          NEXT SCREEN

Return/Enter takes you back to previous screen.
Enter Information supplied to you by your telephone company.
```

### RFC 1483 Options

```
T1 Line Configuration

Operation Mode...      Normal
Line Encoding...      B8ZS
Framing Mode...       ESF

Number of DS0 Channels: 1
First DS0 Channel:    1

Channel Data Rate...   Nx64k

Data Link Encapsulation... RFC1483
RFC1483 Mode...       Bridged 1483
PPP over Ethernet (PPPoE): Off

TO MAIN MENU          NEXT SCREEN

Return/Enter goes to new screen.
Enter Information supplied to you by your telephone company.
```

### ATM Operation Mode Options

```
T1 Line Configuration

Operation Mode...      ATM
Line Encoding...      B8ZS
Framing Mode...       ESF

Number of DS0 Channels: 1
First DS0 Channel:    1

Data Link Encapsulation... RFC1483
RFC1483 Mode...       Bridged 1483
PPP over Ethernet (PPPoE): Off
Data Circuit VPI (0-255): 0
Data Circuit VCI (32-65535): 35

TO MAIN MENU          NEXT SCREEN

Return/Enter goes to new screen.
Enter Information supplied to you by your telephone company.
```

**Note:** If you used Easy Setup to configure your router, you have already created a connection profile called Easy Setup Profile. If you return to the Easy Setup menus and change the Data Link Encapsulation method you set up in this step, the Easy Setup Data Link Encapsulation method will override this one and change the default data link encapsulation method in use.

You are now finished configuring the Line Configuration screen. Press the Escape key to return to the **WAN Configuration** screen.

---

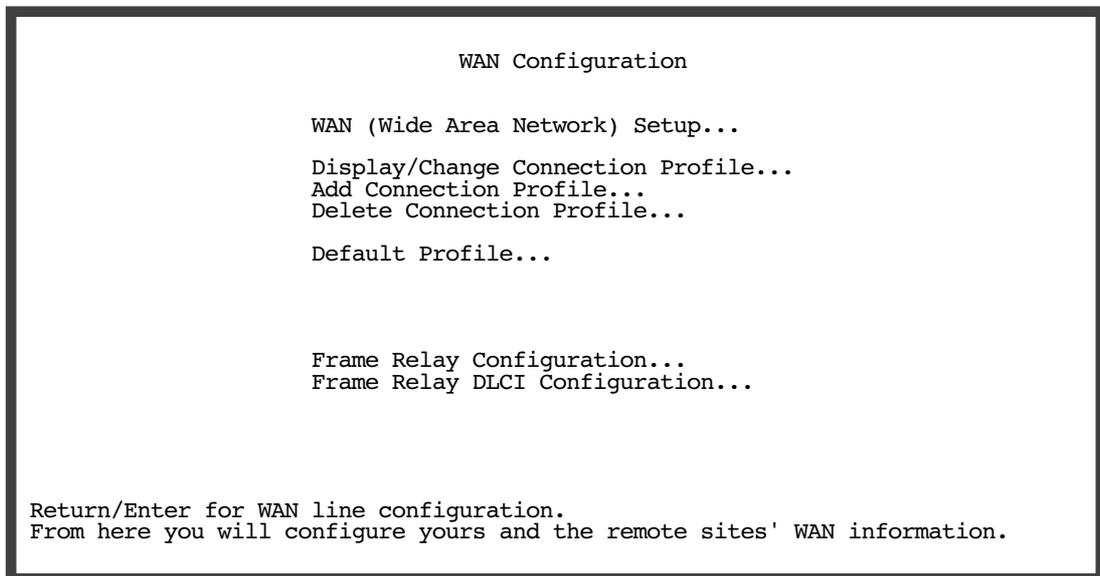
**Note:** If you selected Frame Relay as your data link encapsulation method, see “[Frame Relay Configuration](#)” on page 2-9 for more information.

---

---

## Frame Relay Configuration

If you chose Frame Relay as your data link encapsulation type you can now configure the Frame Relay options from the WAN Configuration menu.



From the WAN Configuration screen, select **WAN Setup**, then select the **Frame Relay Configuration** option and press Return. The Frame Relay Configuration screen appears.

```

                                Frame Relay Configuration

LMI Type...                      ANSI (Annex D)
T391 (Polling Interval in secs): 10
N391 (Polls/Full Status Cycles): 6
N392 (Error Threshold):          3
N393 (Monitored Event Window):  4

Tx Injection Management...       Standard
Default CIR:                     64000
Default Bc:                      64000
Default Be:                      0

Congestion Management Enabled:   No

Maximum Tx Frame Size:          1520

Return/Enter goes to new screen.
Enter Information supplied to you by your telephone company.

```

1. Select **LMI Type** (Link Management Type) and press Return. From the pop-up menu, highlight either **ANSI (Annex D)**, **CCITT (Annex A)**, **LMI**, or **None**. The default is **None**. Press Return.

See “[Frame Relay DLCI configuration](#)” on page 2-11 for instructions.

Specifying the Link Management Type is the first step in configuring Frame Relay.

- If you select an LMI Type (Link Management Type) other than None, the **T391** option specifies the number of seconds between the Status Enquiry messages. The default setting is 10.
- The **N391** option specifies the frequency of full status polls, in increments of the basic (T391) polling cycle. The default setting is 6.
- The **N392** option specifies the maximum number of (link reliability, protocol, and sequence number) error events that can occur within the N393 sliding window. If an N392 threshold is exceeded, the switch declares the Netopia Router inactive. The default setting is 3.
- The **N393** option allows the user to specify the width of the sliding N392 monitored event window. The default setting is 4.

2. Select **Tx Injection Management** and press Return. From the pop-up menu, highlight **Standard** if you want the frames on your line that exceed the configured service parameters to be dropped at the router, **Buffered** if you want the frames on your line that exceed the link capacity to be delayed until the link is less busy, or **None** if you want all of the frames on your line to be transmitted. Press Return.

**Note:** If you select **None** as the Tx Injection Management type, the three Tx Injection Management options listed below will remain hidden. Go to step 4.

If you select **Standard** or **Buffered** as the Tx Injection Management type, then the **Default CIR**, **Bc**, and **Be** values will appear (in the corresponding fields below the Tx Injection Management field) in order for you to define the parameters of the management algorithm.

- The **Default CIR** (CIR also referred to as Committed Information Rate) represents the average capacity available to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). This set-

ting defaults to 64000, but you may modify the capacity rate if this setting will not be applicable to you.

- The **Default Bc** (Bc also referred to as Committed Burst Size) represents the maximum amount of data that your Frame Relay service provider agrees to transfer from a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). This setting defaults to 64000, but you may change the capacity rate if necessary.
- The **Default Be** (Be also referred to as Excess Burst Size) represents the maximum amount of data that your Frame Relay service provider will attempt to deliver to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). This setting defaults to 0, but you may change the capacity rate if necessary.

**Note:** Some Frame Relay service providers allow for over-subscription of the DLCIs, which occurs when the total number of CIRs for all PVCs exceeds the line rate setup.

3. Select **Congestion Management Enabled** and toggle to **Yes** or **No** depending on whether you use this selection. Press Return.

If Congestion Management is enabled, this option causes the Netopia Router to use in-bound FECNs (Forward Explicit Congestion Notification). This feature is designed to notify you that congestion avoidance procedures should be initiated where applicable for traffic in the same direction as the received frame. It indicates that the frame in question has encountered congested resources.

**Note:** The Congestion Management Enabled field will only appear if Standard or Buffered is selected as the option from the Tx Injection Management field.

4. Select **Maximum Tx Frame Size** and press Return. The default is automatically set to a value suitable for encapsulating a full Ethernet packet's transmission load; however you can change the Maximum Frame Size to suit your network's transmission load. Press Return.

You are now finished configuring the Frame Relay Configuration screen. Press the Escape key to return to the WAN Configuration screen. If you need to configure your DLCIs, go to the next section.

## Frame Relay DLCI configuration

If you selected **None** as your LMI Type then you will need to manually configure your DLCIs.

A Frame Relay DLCI is a set of parameters that tells the Netopia Router how to initially connect to a remote destination.

The Netopia Router supports up to 16 different Frame Relay DLCI profiles.

Each Frame Relay DLCI configuration you set up allows the Netopia Router to connect your network to another network that uses IP over Frame Relay.



## Changing a Frame Relay DLCI configuration

To modify a Frame Relay DLCI configuration, select **Display/Change DLCIs** in the Frame Relay DLCI Configuration screen.

Select a DLCI Name from the table and press Return to go to the **Change DLCI** screen. The parameters in this screen are the same as the parameters in the Add DLCI screen. To find out how to set them, see [“Adding a Frame Relay DLCI configuration”](#) on page 2-14.

Change DLCI	
DLCI Name:	DLCI 33
DLCI Enabled:	Yes
DLCI Number (16-991):	32
Remote IP Address:	2.0.0.2

## Adding a Frame Relay DLCI configuration

To add a new Frame Relay DLCI, select **Add DLCI** in the Frame Relay DLCI Configuration screen and press Return. The Add DLCI screen appears.

Add DLCI

DLCI Name:	DLCI 16	
DLCI Enabled:	Yes	
DLCI Number (16-991):	16	
Remote IP Address:	0.0.0.0	
Data Flow Parameters-----	Use Default-----	Value----
CIR:	Yes	
Bc:	Yes	
Be:	Yes	
ADD DLCI NOW		CANCEL

Return accepts \* ESC cancels \* Left/Right moves insertion point \* Del deletes.  
Here you configure the parameters for a single DLCI (Data Link Circuit ID).

1. Select **DLCI Name** and enter a name for this individual Frame Relay DLCI profile. It can be any name you want. For example: the name of your ISP or remote branch you're connecting to such as the corporate headquarters of your company.

**Note:** The Netopia Router allows Frame Relay DLCIs to be named, so that you can easily reference and differentiate them. This is accomplished by giving a DLCI Name to a DLCI Number.

2. Select **DLCI Enabled** and toggle it to **Yes** to activate the profile. If you disable this profile, the Netopia Router will automatically disable and block access to a specific remote DLCI.
3. Select **DLCI Number (16-991)** and enter a number for this individual DLCI. Check with your Frame Relay provider to find out what numbers are allocated for each of your DLCI profiles. The DLCI number range should fall within the range of 16-991.
4. Select **Remote IP Address** and enter the remote IP address your ISP or network administrator gave you that represents the remote sites IP address for their router. Press Return.

If you selected **Standard** or **Buffered** as the Tx Injection Management type in the Frame Relay Configuration screen go to the next bulleted item below. If you selected **None** in the Frame Relay Configuration screen go to step 6.

Below the Remote IP Address field, the following Data Flow Parameters appear:

- The **CIR** (Committed Information Rate) represents the average capacity available to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). The setting defaults to 64000, but you may modify the capacity rate by toggling the selection in the **Use Default** field to **No**. You can then enter a different capacity rate in the **Value** field.
- The **Bc** (Committed Burst Size) represents the maximum amount of data that your Frame Relay service

provider agrees to transfer from a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). The setting defaults to 64000, but you may modify the committed burst size by toggling the selection in the **Use Default** field to **No**. You can then enter a different committed burst size in the **Value** field.

- The **Be** (Excess Burst Size) represents the maximum amount of data that your Frame Relay service provider will attempt to deliver to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). The setting defaults to 0, but you may modify the excess burst size by toggling the selection in the **Use Default** field to **No**. You can then enter a different excess burst size in the **Value** field.

**Note:** Some Frame Relay service providers allow for over-subscription of the DLCIs, which occurs when the total number of CIRs for all PVCs exceeds the line rate setup.

5. Select **ADD DLCI NOW** to save the current static Frame Relay DLCI profile that you have just entered, and press Return to go back to the **Frame Relay DLCI Configuration** screen. Alternately, you can cancel the Frame Relay DLCI profile you have just created by selecting **CANCEL** to exit the Add DLCI screen.

### Deleting a Frame Relay DLCI configuration

To delete a Frame Relay DLCI configuration, select **Delete DLCI** in the Frame Relay DLCI Configuration screen and press Return to display the Frame Relay DLCI configuration table.

```

Frame Relay DLCI Configuration
+-DLCI Name-----DLCI Number-+
| joe                      16 |
+-----+-----+
Are you sure you want to delete this DLCI?
          CANCEL                      CONTINUE
+-----+-----+
          |                           |
          |                           |
          +-----+-----+

```

1. Highlight the Frame Relay DLCI configuration you wish to delete. Press Return.
2. A Frame Relay DLCI Configuration table appears with a prompt asking you if you want to delete the connection profile you have just highlighted. Select **CONTINUE** if you wish to delete this DLCI or **CANCEL** if you do not.

You are now finished configuring the Frame Relay DLCI Configuration screen.

## Multiple ATM Permanent Virtual Circuits

The Netopia Firmware Version 5.4 supports up to eight permanent virtual circuits.

### Multiple ATM PVC overview

On cell-based DSL WAN interfaces, the ATM connection between the device and the central office equipment (DSLAM) is divided logically into one or more virtual circuits (VCs). A virtual circuit may be either a permanent virtual circuit (PVC) or a switched virtual circuit (SVC). Netopia devices support PVCs.

VCs are identified by a Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI). A VPI is an 8-bit value between 0 and 255, inclusive, while a VCI is a 16-bit value between 0 and 65535, inclusive.

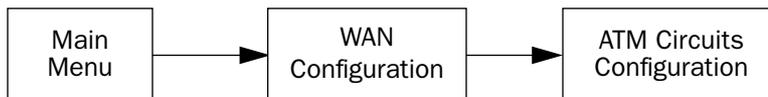
- Circuits now support attributes in addition to their VPI and VCI values. When configuring a circuit, you can specify an optional circuit name of up to 14 characters. The circuit name is used only to identify the circuit for management purposes as a convenience to aid in selecting circuits from lists. The default circuit name is “Circuit <n>”, where <n> is some number between one and eight corresponding to the circuit’s position in the list of up to eight circuits.
- You can also individually enable or disable a circuit without deleting it. This is useful for temporarily removing a circuit without losing the configured attributes.
- In order to function, each circuit must be bound to a Connection Profile or to the Default Profile. Among other attributes, the profile binding specifies the IP addressing information for use on the circuit. Each circuit must be bound to a distinct Connection Profile. You cannot bind multiple circuits to the same Connection Profile.

### Multiple ATM PVC configuration

**ATM VPI/VCI Autodetection.** You can bind multiple circuits to the same Connection Profile. Netopia Firmware Version 5.4 allows you to have a standard configuration that uses, for example, four VCs (0/35, 0/38, 8/35, 8/38) pointing to the same profile.

The unit will now automatically select the active VC on networks with a VPI/VCI of any of these four values without any custom configuration of the unit. You must, however, manually create these VCs and associate them with the profile you desire.

You configure Virtual Circuits in the Add/Change Circuit screen.





## Quality of Service (QoS) settings

- Select the **QoS** (Quality of Service) setting from the pop-up menu: **UBR**. or **CBR**.

**UBR:** No configuration is needed for UBR VCs. Leave the default value 0 (maximum line rate).

**CBR:** One parameter is required for CBR VCs. Enter the **Peak Cell Rate** that applies to the VC. This value should be between 1 and the line rate. You set this value according to specifications defined by your service provider.

Add Circuit	
Circuit Name:	Circuit 2
Circuit Enabled:	Yes
Circuit VPI (0-255):	0
Circuit VCI (32-65535):	32
QoS...	CBR
Peak Cell Rate (0 = line rate):	0
Use Connection Profile...	Default Profile
Use Default Profile for Circuit	
ADD Circuit NOW	CANCEL

Return accepts \* ESC cancels \* Left/Right moves insertion point \* Del deletes.

- The **Peak Cell Rate** field is editable. Netopia Firmware Version 5.4 supports two ATM classes of service for data connections: Unspecified Bit Rate (UBR) and Constant Bit Rate (CBR). You can configure these classes of service on a per VC basis. The default ATM class of service is UBR.
- Then, select a Connection Profile for the Circuit. To use the Default Profile, select **Use Default Profile for Circuit** and press Return. For other options, select a profile from the **Use Connection Profile** pop-up menu.

---

**Note:** With multiple VCs you must explicitly statically bind the *second* (and all subsequent) VCs to a profile. The first VC will automatically statically bind according to pre-defined dynamic binding rules when you add the second VC. It will revert back to dynamic binding if the number of VCs is reduced to one; for example, by deleting previously defined VCs.

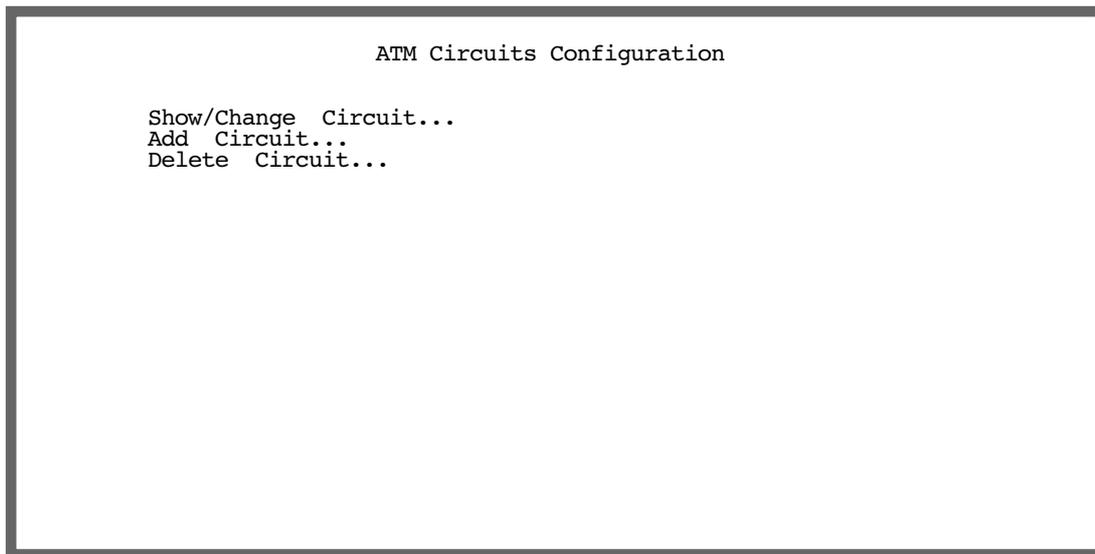
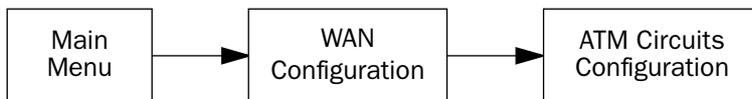
When the link comes up the router binds the VC dynamically to the first suitable Connection Profile or to the Default Profile if there is no Connection Profile configured.

- If you factory default the router, the VC binds to the Default Profile.
- If you delete a Connection Profile that is statically bound to a VC, the VC binding is set back to the Default Profile. If there is only one VC defined, the VC dynamically binds to the first suitable profile or to the Default Profile. If there are multiple VCs defined, it binds to the Default Profile.
- If you add a second VC, it is initialized to the Default Profile, and the menu screens display the VC Connection Profile-related items, allowing you to bind to a specific Connection Profile instead of the Default Profile. In addition, the router statically binds the first VC according to the rules used to select a profile for dynamic binding. At this point, each profile uses static binding when the link is brought up.
- If there are no VCs when you add a VC – for example, if you deleted all your previous VCs and started adding them again – dynamic binding will occur when the link comes up. If you delete a VC, leaving only one VC, that VC resumes dynamically binding again.

- 
- Select **ADD Circuit NOW** and press Return.
4. To display or change a circuit, select **Display/Change Circuit**, select a circuit from the pop-up menu, and press Return. The fields are the same as those in the Add Circuit screen.
  5. To delete a circuit, select Delete Circuit, select a circuit from the pop-up menu, and press Return. In the confirmation window, select CONTINUE and press Return.
  6. Press Escape to return to the WAN Setup menu.

## Editing circuits

You configure Virtual Circuits in the ATM Circuits Configuration screen. From the Main Menu, navigate to the ATM Circuits Configuration screen.



Select **Show/Change Circuit** and press Return.

Choosing **Show/Change Circuit** (or **Delete Circuit**) displays a pop-up menu that allows you to select the circuit to be modified or deleted.

```

ATM Circuits Configuration
+---Circuit Name-----VPI/VCI---+
+-----+
| Circuit 1           8/35          |
| Voice Circuit      0/0           |
+-----+

Show/Change Circuit...
Add Circuit...
Delete Circuit...

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

## Changing a circuit

If you want to make any changes to the circuit you select, you make them in the Change Circuit screen.

```

Change Circuit

Circuit Name:           Circuit 1
Circuit Enabled:       +-----+
Traffic Type...        +-----+
                       | Voice   |
                       | Data    |
                       +-----+
Circuit VPI (0-255):   38
Circuit VCI (0-65535): 38
Connection Profile is  Easy Setup Profile

```

- **Circuit Name** allows you to associate a one- to fourteen-character name with the circuit. The default circuit name is “Circuit <n>”, where <n> is some number between one and eight corresponding to the circuit’s position in the list of up to eight circuits.

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- **Circuit Enabled** allows you to enable or disable the circuit, using the Tab key. The default is enabled.
- **Traffic Type** allows you to select which type of traffic will be routed on this circuit, Voice or Data. If you choose Voice, the *Connection Profile* is field becomes unavailable and does not display.
- **Circuit VPI** allows you to specify the Virtual Path Identifier (VPI) value for the circuit. The default VPI value for both ADSL and cell-based DSL is zero (0).
- **Circuit VCI** allows you to specify the Virtual Channel Identifier (VCI) value for the circuit. The default VCI value depends on the type of DSLAM to which you are connecting.
- Accessing the **Connection Profile Is** field in the Change Circuit menu depends not on the number of Connection Profiles you have created, but the number of *data* VCs you have added. (See “[Multiple ATM PVC configuration](#)” on page 2-16.) If you have more than one data VC you can choose how Connection Profiles are associated with VCs, otherwise you get default behavior and the Connection Profile Is field cannot be selected.

## Monitoring multiple virtual circuits

The General Statistics screen adds a selection for ATM VC Statistics.

To access the ATM VC Statistics screen navigate from the Main Menu to Statistics & Logs then General Statistics.



The General Statistics screen appears.

General Statistics								
Physical I/F	Rx Bytes	Tx Bytes	Rx Pkts	Tx Pkts	Rx Err	Tx Err		
Ethernet Hub	0	0	0	0	0	0		
Aux Async	0	0	0	0	0	0		
ATM SDSL 1	22152	5092	403	404	0	0		
Network	Rx Bytes	Tx Bytes	Rx Pkts	Tx Pkts	Rx Err	Tx Err		
IP	0	0	0	0	0	0		
VC Traffic Statistics...								

Select **VC Traffic Statistics**.

The ATM VC Statistics screen appears.

ATM VC Statistics						
VPI/VCI	Local IP Addr	Frames Rx	Frames Tx	Bytes Rx	Bytes Tx	
0/39	111.222.333.4	0	0	0	0	
8/36	--	1	0	70	0	

-----SCROLL UP-----

-----SCROLL DOWN-----

- To display more information about each circuit associated with the selected WAN module, use the up or down arrow key to highlight the circuit you want to view. Press Return.

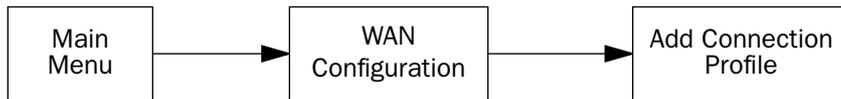
A pop-up window appears, displaying detailed information for the selected circuit.

ATM VC Statistics			
View St	-----+-----		
VPI/VCI	-----+-----		
0/39	Circuit Name:	Circuit 4	
8/36	Connection Profile Name:	Profile 4	
	Bytes Rx:	0	
	Bytes Tx:	0	
	Frames Rx:	0	Frames Tx: 0
	Frames Rx Discarded:	0	Frames Tx Discarded: 0
	Errors Rx:	0	
	Errors Tx:	0	
	OK		

## Creating a New Connection Profile

Connection profiles are useful for configuring the connection and authentication settings for negotiating a PPP connection on a DSL link. If you are using the PPP data link encapsulation method, you can store your authentication information in the connection profile so that your user name and password (or host name and secret) are transmitted when you attempt to connect.

Connection profiles define the networking protocols necessary for the router to make a remote connection. A connection profile is like an address book entry describing how the router is to get to a remote site, or how to recognize and authenticate a connection. To create a new connection profile, you navigate to the WAN Configuration screen from the Main Menu, and select **Add Connection Profile**.



The **Add Connection Profile** screen appears.

Add Connection Profile

Profile Name:	Profile 1
Profile Enabled:	Yes
Encapsulation Type...	RFC1483
RFC1483 Mode...	Bridged 1483
IP Profile Parameters...	
COMMIT	CANCEL

Return accepts \* ESC cancels \* Left/Right moves insertion point \* Del deletes.  
Configure a new Conn. Profile. Finished? COMMIT or CANCEL to exit.

On a Netopia Router you can add up to 15 more connection profiles, for a total of 16, but you can only use one at a time, unless you are using VPNs.

1. Select **Profile Name** and enter a name for this connection profile. It can be any name you wish. For example: the name of your ISP.
2. Toggle **Profile Enabled** to **Yes** or **No**. The default is Yes. You can toggle it to No, if you want to disable it later.
3. Select **Encapsulation Type** and press Return. The pop-up menu offers the possible data link encapsulation methods for connection profiles used for a variety of purposes: PPP, RFC1483, ATMP, PPTP, IPsec, or L2TP.

## Multiple Data Link Encapsulation Settings

4. Select **Encapsulation Options** and press Return.

- If you selected ATMP, PPTP, L2TP, or IPSec, see [Chapter 4, “Virtual Private Networks \(VPNs\).”](#)
- If you selected PPP or RFC1483, the screen offers different options:

```

                                Add Connection Profile

Profile Name:                    Profile 1
Profile Enabled:                 Yes

Encapsulation Type...           +-----+
RFC1483 Mode...                 | Bridged 1483 |
                                | Routed 1483  |
                                +-----+

IP Profile Parameters...

COMMIT                          CANCEL

```

- If you selected RFC1483, the screen allows you to choose **Bridged 1483** or **Routed 1483**.

```

                                Add Connection Profile

Profile Name:                    Profile 1
Profile Enabled:                 Yes

Encapsulation Type...           PPP
Underlying Encapsulation...     None
PPP Mode...                      VC Multiplexed
Encapsulation Options...

IP Profile Parameters...

Interface Group...              Primary

COMMIT                          CANCEL

Configure a new Conn. Profile. Finished? COMMIT or CANCEL to exit.

```

- If you selected PPP, the screen allows you to choose **PPPoE** or **None** as the **Underlying Encapsulation**.
- If you choose **None**, the **PPP Mode** offers the choice of **VC Multiplexed** or **LLC SNAP**.

If you are using PPP, when you select **Encapsulation Options**, the Datalink (PPP/MP) Options screen appears. (RFC1483 does not require these options and does not offer the menu selection.)

Datalink (PPP/MP) Options	
Data Compression...	Standard LZS
Send Authentication...	PAP
Send User Name:	
Send Password:	
Receive User Name:	
Receive Password:	

Datalink (PPP/MP) Options	
Data Compression...	Standard LZS
Send Authentication...	PAP
Send User Name:	
Send Password:	
Receive User Name:	
Receive Password:	
Dial on Demand:	Yes

- **Data Compression** defaults to **Standard LZS**. You can select **Ascend LZS**, if you are connecting to compatible equipment, or **None** from the pull-down menu.
- The **Send Authentication** pull-down menu lets you select **PAP**, **CHAP**, or **None**.
- Selecting PAP or CHAP allows you to enter your authentication credentials for both *sending* and *receiving* connections. PAP requires a **User Name** and **Password**; CHAP requires a **Host Name** and **Secret**. The screen changes to accommodate your selection.
- If you are creating a Backup profile (supported models only), and have selected Backup as the Interface Group in the previous screen, you can toggle **Dial on Demand** to Yes (the default) or No. See “[Line Backup](#)” on page 7-1 for more information.

Return to the Add Connection Profile screen by pressing Escape.

5. Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

```

IP Profile Parameters

Address Translation Enabled:      Yes
IP Addressing...                 Numbered

NAT Map List...                  Easy-PAT List
NAT Server List...              Easy-Servers

Local WAN IP Address:           0.0.0.0
Local WAN IP Mask:              0.0.0.0

Filter Set...
Remove Filter Set

RIP Profile Options...

```

6. Toggle or enter any IP Parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information, see [“IP Setup” on page 6-2](#).
7. Select **COMMIT** and press Return. Your new Connection Profile will be added.

If you want to view the Connection Profiles in your device, return to the WAN Configuration screen, and select **Display/Change Connection Profile**. The list of Connection Profiles is displayed in a scrolling pop-up screen.

```

WAN Configuration
+--Profile Name-----IP Address-----+
+-----+-----+
Easy Setup Profile      255.225.255.255
Profile 1                0.0.0.0
+-----+-----+

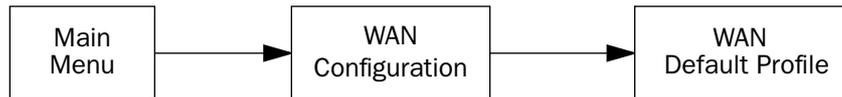
```

---

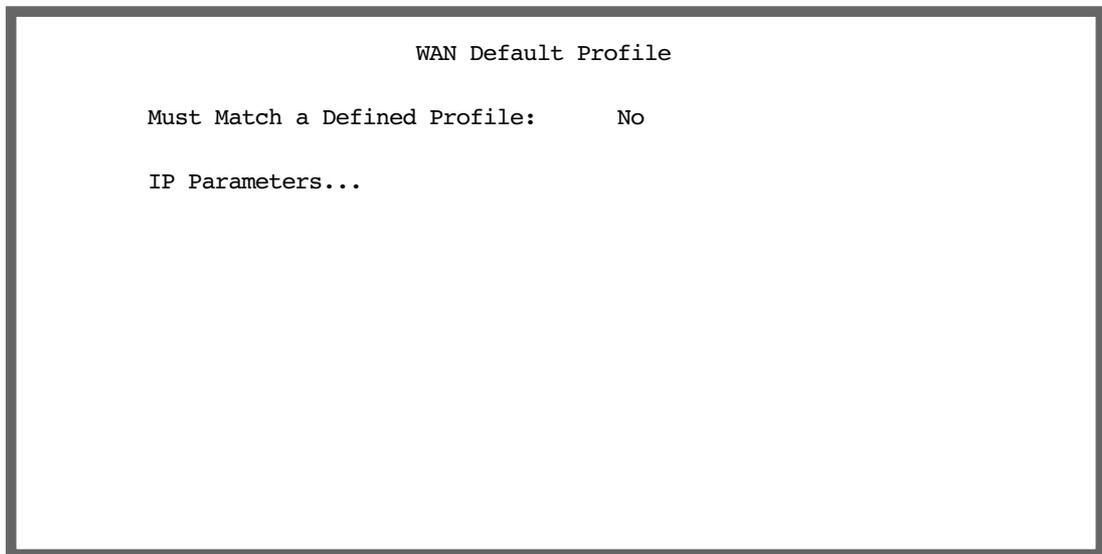
## The Default Profile

If you are using RFC1483 data link encapsulation, the Default Profile screen controls whether or not the DSL link will come up without an explicitly configured connection profile. (PPP datalink encapsulation does not support a default profile, and the corresponding menu item is unavailable.) See [“Connection Profiles” on page 6-32](#) for more information.

You access the Default Profile screen from the Main Menu by selecting WAN Configuration and then selecting **Default Profile**.



The Default Profile screen appears.



- You can set **Must Match a Defined Profile** item to **Yes** or **No** (the default). This item controls whether or not the DSL link will come up without an explicitly configured connection profile. If your ISP is serving you a dynamic IP Address, you need not explicitly configure a connection profile, and the default behavior of the router will be to connect automatically once it is powered on.

## IP parameters (default profile) screen

If you are using RFC1483 datalink encapsulation, the IP Parameters (Default Profile) screen allows you to configure various IP parameters for DSL connections established without an explicitly configured connection profile:

IP Parameters (Default Profile)

Address Translation Enabled:            No

Filter Set (Firewall)...  
Remove Filter Set

Receive RIP:                                Both  
Transmit RIP:                               Off

Return/Enter accepts \* Tab toggles \* ESC cancels.

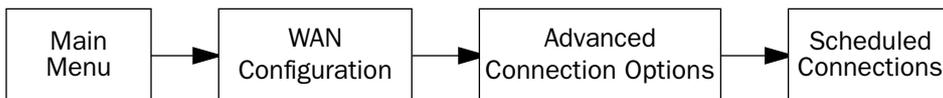
For an DSL link, Network Address Translation (NAT) is disabled by default in the Default Profile. You can enable it by toggling to Yes. For details on setting up IP Parameters see [“IP Setup” on page 6-2](#).

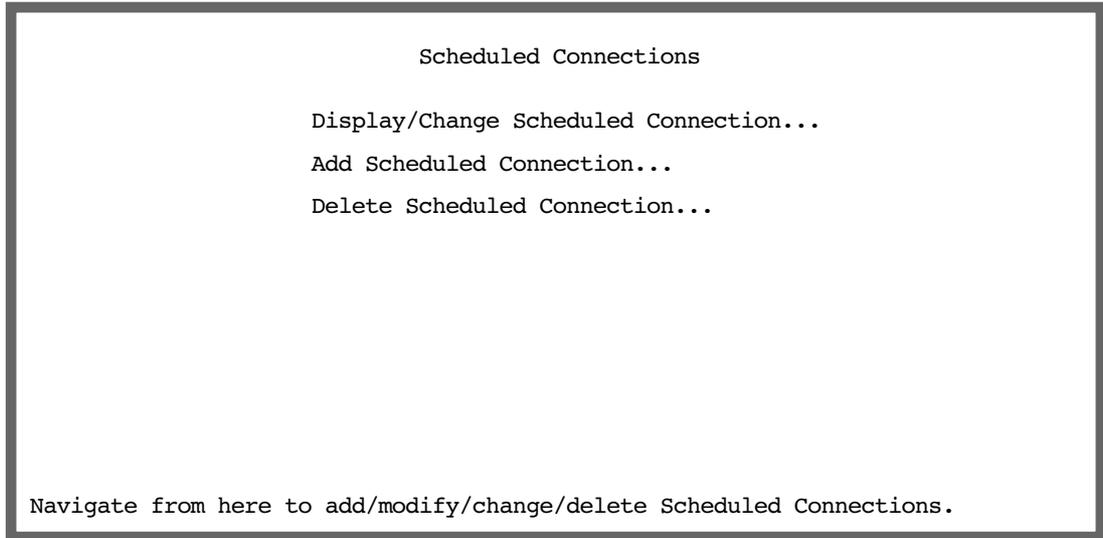
---

## Scheduled Connections

Scheduled connections are useful for PPPoE, PPTP, and ATMP connection profiles.

To go to the Scheduled Connections screen, from the WAN Configuration screen select **Advanced Connection Options** and then select **Scheduled Connections**.





## Viewing scheduled connections

To display a table of scheduled connections, select **Display/Change Scheduled Connection** in the Scheduled Connections screen. Each scheduled connection occupies one row of the table.

Scheduled Connections

+Days----	Begin At---HH:MM---	When----	Conn. Prof. Name----	Enabled-----+
mtWtfss	08:30PM	06:00 weekly	Profile 01	No

The first column in the table shows a one-letter representation of the **Days** of the week, from Monday (M or m) to Sunday (S or s). If a letter representing a day is capitalized, the connection will be activated on that day; a lower-case letter means that the connection will not be activated on that day. If the scheduled connection is configured for a once-only connection, the word “once” will appear instead of the days of the week.

The other columns show:

- The time of day that the connection will **Begin At**
- The duration of the connection (**HH:MM**)
- Whether it's a recurring **Weekly** connection or used **Once Only**
- Which connection profile (**Conn. Prof.**) is used to connect
- Whether the scheduled connection is currently **Enabled**

The router checks the date and time set in scheduled connections against the system date and time.

## Adding a scheduled connection

To add a new scheduled connection, select **Add Scheduled Connection** in the Scheduled Connections screen and press Return. The Add Scheduled Connection screen appears.

Add Scheduled Connection

Scheduled Connection Enable:	On
How Often...	Weekly
Schedule Type...	Forced
Set Weekly Schedule...	
Use Connection Profile...	

ADD SCHEDULED CONNECTION
CANCEL

Scheduled Connections dial remote Networks on a Weekly or Once-Only basis.

Follow these steps to configure the new scheduled connection:

- To activate the connection, select **Scheduled Connection Enable** and toggle it to **On**. You can make the scheduled connection inactive by toggling **Scheduled Connection Enable** to **Off**.
- Decide how often the connection should take place by selecting **How Often** and choosing **Weekly** or **Once Only** from the pop-up menu.
- The **Schedule Type** allows you to set the exact weekly schedule or once-only schedule.

Options are:

- **Forced Up**, meaning that this connection will be maintained whether or not there is a demand call on the line.
- **Forced Down**, meaning that this connection will be torn down or blocked whether or not there is a

demand call on the line.

- **Demand-Allowed**, meaning that this schedule will permit a demand call on the line.
- **Demand-Blocked**, meaning that this schedule will prevent a demand call on the line.
- **Periodic**, meaning that the connection is retried several times during the scheduled time.
- If **How Often** is set to **Weekly**, the item directly below **How Often** reads **Set Weekly Schedule**. If **How Often** is set to **Once Only**, the item directly below **How Often** reads **Set Once-Only Schedule**.

## Set Weekly Schedule

If you set **How Often** to **Weekly**, select **Set Weekly Schedule** and go to the Set Weekly Schedule screen.

- Select the days for the scheduled connection to occur and toggle them to **Yes**.

Set Weekly Schedule

Monday:	No
Tuesday:	No
Wednesday:	No
Thursday:	No
Friday:	No
Saturday:	No
Sunday:	No
Scheduled Window Start Time:	11:50
AM or PM:	AM
Scheduled Window Duration Per Day:	00:00

- Select **Scheduled Window Start Time** and enter the time to initiate the scheduled connection.
- You must enter the time in the format H:M, where H is a one- or two-digit number representing the hour and M is a one- or two-digit number representing the minutes. The colon is mandatory. For example, the entry 1:3 (or 1:03) would be accepted as 3 minutes after one o'clock. The entry 7:0 (or 7:00) would be accepted as seven o'clock, exactly. The entries 44, :5, and 2: would be rejected.
- Select **AM or PM** and choose **AM** or **PM** from the pop-up menu.
- Select **Scheduled Window Duration Per Day** and enter the maximum duration allowed for this scheduled connection, per call.

You are finished configuring the weekly options. Return to the Add Scheduled Connection screen to continue.

## Set Once-Only Schedule

If you set **How Often** to **Once Only**, select **Set Once-Only Schedule** and go to the Set Once-Only Schedule screen.

Set Once-Only Schedule

Place Call on (MM/DD/YY):	05/07/1998
Scheduled Window Start Time: AM or PM:	11:50 AM
Scheduled Window Duration:	00:00

- Select **Place Call On (Date)** and enter a date in the format MM/DD/YY or MM/DD/YYYY (month, day, year).

**Note:** You must enter the date in the format specified. The slashes are mandatory. For example, the entry 5/7/98 would be accepted as May 7, 1998. The entry 5/7 would be rejected.

- Select **Scheduled Window Start Time** and enter the time to initiate the scheduled connection.

**Note:** You must enter the time in the format H:M, where H is a one- or two-digit number representing the hour and M is a one- or two-digit number representing the minutes. The colon is mandatory. For example, the entry 1:3 (or 1:03) would be accepted as 3 minutes after one o'clock. The entry 7:0 (or 7:00) would be accepted as seven o'clock, exactly. The entries 44, :5, and 2: would be rejected.

- Select **AM or PM** and choose **AM** or **PM**.
- Select **Scheduled Window Duration** and enter the maximum duration allowed for this scheduled connection. Use the same format restrictions noted above.

You are finished configuring the once-only options. Return to the Add Scheduled Connection screen to continue.

- In the Add Scheduled Connection screen, select **Use Connection Profile** and choose from the list of connection profiles you have already created. A scheduled connection must be associated with a connection profile to be useful. The connection profile becomes active during the times specified in the associated scheduled connection, if any exists.
- Select **ADD SCHEDULED CONNECTION** to save the current scheduled connection. Select **CANCEL** to exit the Add Scheduled Connection screen without saving the new scheduled connection.

## Modifying a scheduled connection

To modify a scheduled connection, select **Display/Change Scheduled Connection** in the Scheduled Connections screen to display a table of scheduled connections.

Select a scheduled connection from the table and press Return. The Change Scheduled Connection screen appears. The parameters in this screen are the same as the ones in the Add Scheduled Connection screen (except that **ADD SCHEDULED CONNECTION** and **CANCEL** do not appear). To find out how to set them, see [“Adding a scheduled connection” on page 2-31](#).

## Deleting a scheduled connection

To delete a scheduled connection, select **Delete Scheduled Connection** in the Scheduled Connections screen to display a table of scheduled connections.

Select a scheduled connection from the table and press the Return key to delete it. To exit the table without deleting the selected scheduled connection, press the Escape key.

## System Configuration Screens

### System configuration features

The Netopia Firmware Version 5.4 default settings may be all you need to configure your Router. Some users, however, require advanced settings or prefer manual control over the default selections. For these users, Netopia Firmware Version 5.4 provides system configuration options.

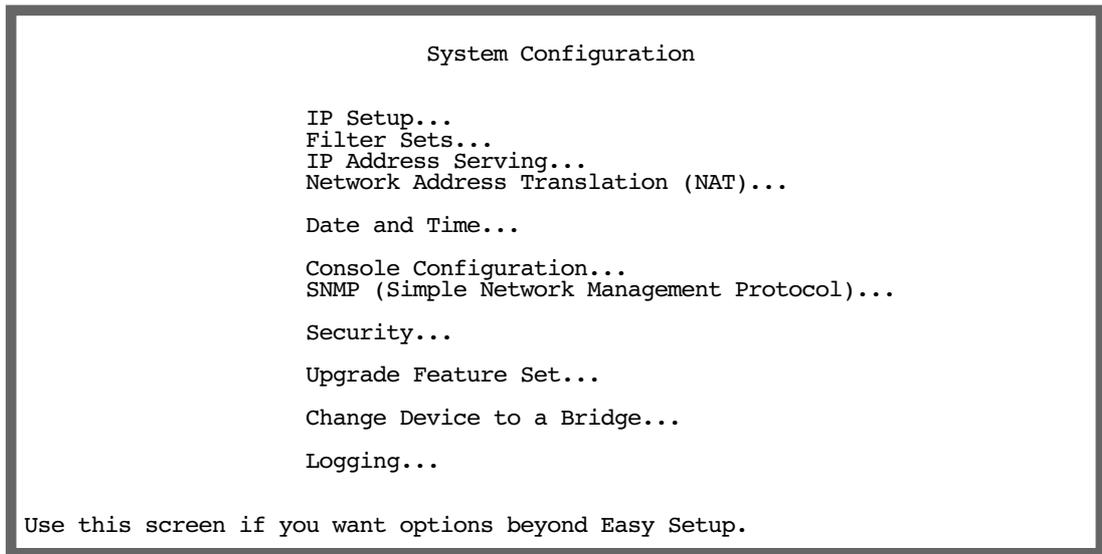
<a href="#">“IP Setup” on page 2-36</a>	<a href="#">“Filter Sets” on page 2-36</a>
<a href="#">“IP Address Serving” on page 2-36</a>	<a href="#">“Network Address Translation (NAT)” on page 2-36</a>
<a href="#">“Date and time” on page 2-42</a>	<a href="#">“Stateful Inspection firewall” on page 2-37</a>
<a href="#">“SNMP (Simple Network Management Protocol)” on page 2-43</a>	<a href="#">“Console Configuration” on page 2-43</a>
<a href="#">“Upgrade Feature Set” on page 2-43</a>	<a href="#">“Security” on page 2-43</a>
<a href="#">“Logging” on page 2-46</a>	<a href="#">“RFC-1483 Transparent Bridging” on page 2-44</a>

To help you determine whether you need to use the system configuration options, review the following requirements. If you have one or more of these needs, use the system configuration options described in later chapters.

- System configuration of dynamic IP address distribution through DHCP or BootP
- Greater network security through the use of filters
- Use of Network Time Protocol

To access the system configuration screens, select **System Configuration** in the Main Menu, then press Return.

The System Configuration menu screen appears:



### IP Setup

These screens allow you to configure your network's use of the IP networking protocol.

- Details are given in [“IP Setup” on page 6-2](#).

### Filter Sets

These screens allow you to configure security on your network by means of filter sets and a basic firewall.

- Details are given in [“Security” on page 10-1](#).

### IP Address Serving

These screens allow you to configure IP address serving on your network by means of DHCP, WANIP, and BootP.

- Details are given in [“IP Address Serving” on page 6-17](#).

### Network Address Translation (NAT)

These screens allow you to configure the Multiple Network Address Translation (MultiNAT) features.

- Details are given in [“Multiple Network Address Translation” on page 3-1](#).

## Stateful Inspection firewall

Stateful inspection firewall is a security feature that prevents unsolicited inbound access when NAT is disabled. You can configure UDP and TCP “no-activity” periods that will also apply to NAT time-outs if stateful inspection is enabled on the interface. Stateful Inspection parameters are active on a WAN interface only if enabled on your Gateway. Stateful inspection can be enabled on a profile whether NAT is enabled or not.

```

Stateful Inspection

UDP no-activity timeout (sec):          180
TCP no-activity timeout (sec):         14400
Add Exposed Address List...

Exposed Address Associations...

Return/Enter goes to new screen.
Return/Enter to configure Xposed IP addresses.

```

- **UDP no-activity time-out:** The time in seconds after which a UDP session will be terminated, if there is no traffic on the session.
- **TCP no-activity time-out:** The time in seconds after which an TCP session will be terminated, if there is no traffic on the session.
- **Exposed Addresses:** The hosts specified in Exposed addresses will be allowed to receive inbound traffic even if there is no corresponding outbound traffic. This is active only if NAT is disabled on an WAN interface.

## Stateful Inspection Options

Enable and configure stateful inspection on a WAN interface.

```

                                IP Profile Parameters

Address Translation Enabled:      Yes
IP Addressing...                 Numbered
NAT Map List...                 Easy-PAT List
NAT Server List...             Easy-Servers
NAT Options...
Stateful Inspection Enabled:     No

Local WAN IP Address:           0.0.0.0
Local WAN IP Mask:              0.0.0.0

Filter Set...
Remove Filter Set

RIP Profile Options...

Return/Enter to select <among/between> ...
Configure IP requirements for a remote network connection here.

```

When you create or modify a Connection Profile, the IP Profile Parameters screen allows you to enable Stateful Inspection on that profile by toggling **Stateful Inspection Enabled** to **Yes**. By default, this is turned off (No). If you enable Stateful Inspection, the Stateful Inspection Options field appears.

```

                                IP Profile Parameters

Address Translation Enabled:      No
IP Addressing...                 Numbered

Stateful Inspection Enabled:     Yes
Stateful Inspection Options...
Local WAN IP Address:           0.0.0.0
Local WAN IP Mask:              0.0.0.0

Filter Set...
Remove Filter Set

RIP Profile Options...

Configure IP requirements for a remote network connection here.

```

Select **Stateful Inspection Options** and press Return. The Stateful Inspection Parameters screen appears.

## Stateful Inspection Parameters

Max. TCP Sequence Number Difference:	0
Enable default mapping to router:	No
Deny Fragmented Packets:	No
Exposed Address List...	

Enter max. allowed TCP sequence number difference (1 - 65535), 0 to disable.

- **Max. TCP Sequence Number Difference:** Enter a value in this field. This value represents the maximum sequence number difference allowed between subsequent TCP packets. If this number is exceeded, the packet is dropped. The acceptable range is 0 – 65535. A value of 0 (zero) disables this check.
- **Enable default mapping to router:** This is disabled by default. Toggling this option to **Yes** will allow the router to respond to traffic received on this interface, for example, ICMP Echo requests.

---

**Note:** If Stateful Inspection is enabled on a base connection profile (for example, for PPP, RFC1483 bridged/routed, or PPPoE), **Enable default mapping to router** must be **yes** to allow inbound VPN terminations. (for example. for PPTP/ATMP client access to the router)

---

- **Deny Fragmented Packets:** Toggling this option to **Yes** causes the router to discard fragmented packets on this interface.
- You can apply these parameters to your Exposed Address lists by selecting your **Exposed Address List** from the pop-up menu,

```

                                Stateful Inspection Parameters
                                +Exposed Address List N+
                                +-----+
Max. TCP Sequ  my_xposed_list      0
Enable default <<None>>          No
Deny Fragment                               No
Exposed Adresse
                                +-----+

```

Up/Down Arrows to select, then Return/Enter; ESC to cancel.

## Exposed Addresses

You can specify the IP addresses you want to expose by selecting **Add Exposed Address List** and pressing Return. The Add Exposed Address List screen appears.

```

                                Add Exposed Address List

Exposed Address List Name:      my_xposed_addr_list

Return accepts * ESC cancels * Left/Right moves insertion point * Del deletes.

```

Add, Edit, or delete exposed addresses options are active only if NAT is disabled on a WAN interface. The hosts specified in exposed addresses will be allowed to receive inbound traffic even if there is no corresponding outbound traffic.

```

Change Exposed Address Range ("my_xposed_list")

First Exposed Address:      192.168.1.10
Last Exposed Address:      +-----+
                             +-----+
Protocol...                 | TCP and UDP |
                             |   TCP       |
Port Start:                 |   UDP       |
                             |   ANY       |
                             +-----+
Port End:

CHANGE EXPOSED ADDRESS RANGE      CANCEL

```

- **Start Address:** Start IP Address of the exposed host range.
- **End Address:** End IP Address of the exposed host range
- **Protocol:** Select the Protocol of the traffic to be allowed to the host range from the pull-down menu. Options are Any, TCP, UDP, or TCP/UDP.
- **Start Port:** Start port of the range to be allowed to the host range. The acceptable range is from 1 - 65535
- **End Port:** Protocol of the traffic to be allowed to the host range. The acceptable range is from 1 - 65535

You can edit or delete exposed address lists by selecting **Show/Change Exposed Address List** or **Delete Exposed Address List**. A list of previously configured exposed addresses appears.

```

Add Exposed Address List
+-----Exposed Address Range-----Protocol-----+
| 192.168.1.10   192.168.1.12   TCP and UDP         |
|                                                       |
|                                                       |
|                                                       |
|                                                       |
+-----+
Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

This allows you to select an exposed address list for editing or deletion.

## Date and time

You can set the system's date and time parameters in the Set Date and Time screen.

Select **Date and Time** in the System Configuration screen and press Return. The Set Date and Time screen appears.

Set Date and Time

NTP (Network Time Prot.) Enabled:	On
Time Server Host Name/IP Address	204.152.184.72
Time Zone...	GMT -8:00 Pacific Standard Time
NTP Update Interval (HHHH:MM)	0:00
System Date Format:	MM/DD/YY
System Time Format:	AM/PM

Follow these steps to set the system's date and time:

1. Toggle **NTP (Network Time Prot.) Enabled** to On to synchronize the Router's time and date with a network server. Toggle this field to Off to manually set the time and date; the options in this screen will change to allow you to manually enter the time and date parameters.

---

**Note:** If time and date are manually set, that information will be lost upon reboot or loss of power.

---

2. Enter the IP address of the time server in the field **Time Server Host Name/IP Address**.
3. Select the Router's time zone from the **Time Zone** pop-up menu and press Return.
4. In the **NTP Update Interval** field, enter how often to synchronize with the time server, using the format HHHH:MM where H is hours and M is minutes.
5. Select a **System Date Format**; the options are MM/DD/YY, DD/MM/YY, and YY/MM/DD, where M is month, D is day, and Y is year.
6. Select a **System Time Format**, either AM/PM or 24hrs.
7. Press Escape to return to the System Configuration menu.

---

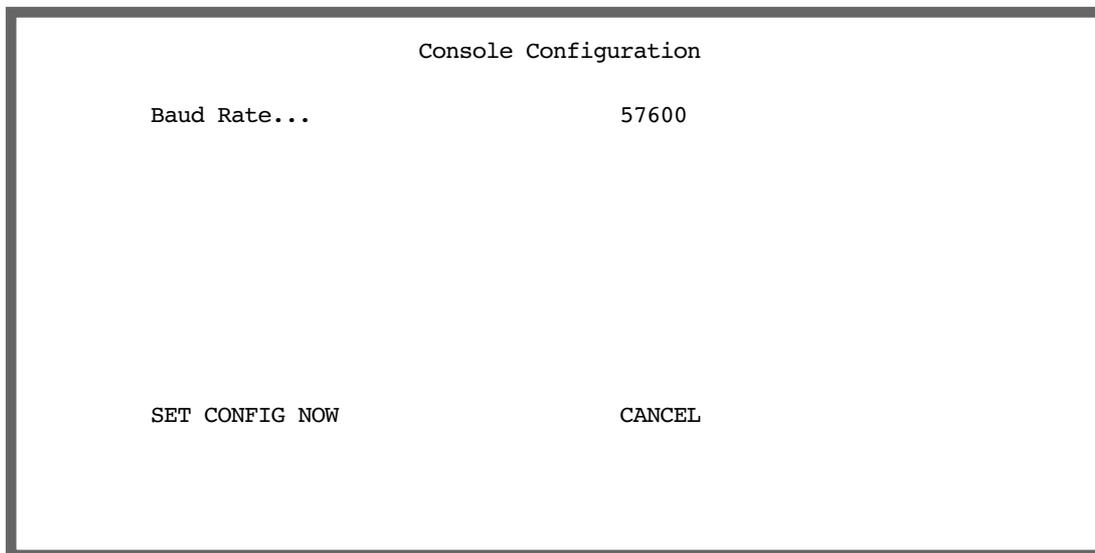
**Note:** NTP can be blocked by some firewall configurations. To ensure that this feature works, create a filterset rule to allow UDP port 123 to be open.

---

## Console Configuration

You can change the default terminal communications parameters to suit your requirements.

To go to the Console Configuration screen, select **Console Configuration** in the System Configuration screen.



The screenshot shows a window titled "Console Configuration". Inside the window, the text "Baud Rate..." is on the left and "57600" is on the right. At the bottom of the window, there are two buttons: "SET CONFIG NOW" on the left and "CANCEL" on the right.

Follow these steps to change a parameter's value:

1. Select 57600, 38400, 19200, or 9600.
2. Select **SET CONFIG NOW** to save the new parameter settings. Select **CANCEL** to leave the parameter unchanged and exit the Console Configuration screen.

## SNMP (Simple Network Management Protocol)

These screens allow you to monitor and configure your network by means of a standard Simple Network Management Protocol (SNMP) agent.

- Details are given in [“Simple Network Management Protocol \(SNMP\) - V2c” on page 9-10.](#)

## Security

These screens allow you to add users and define passwords on your network.

- Details are given in [“Security” on page 10-1.](#)

## Upgrade Feature Set

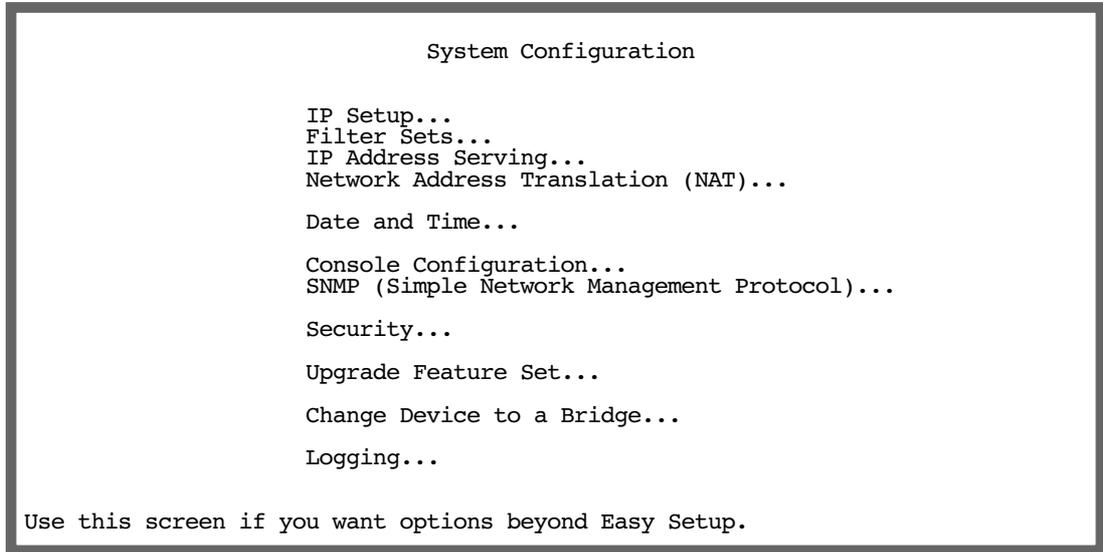
You can upgrade your Router by adding new feature sets through the Upgrade Feature Set utility.

See the release notes that came with your router or feature set upgrade, or visit the Netopia Web site at [www.netopia.com](http://www.netopia.com) for information on new feature sets, how to obtain them, and how to install them on your Router.

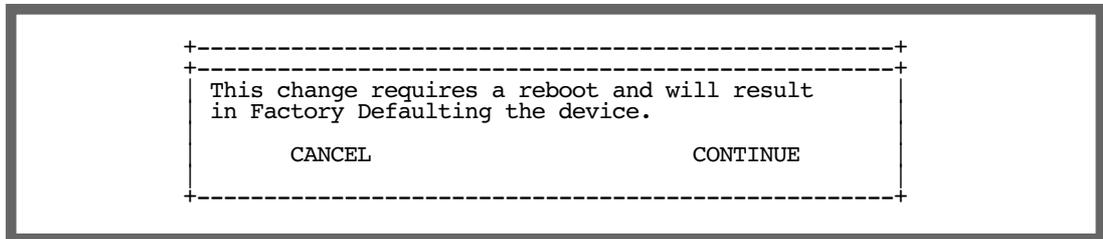
## RFC-1483 Transparent Bridging

This feature allows you to turn off the routing features and use your device as a bridge. If you select this option, the device will restart itself, and reset all the settings to factory defaults. Any configurations you have made will be erased. Use this feature with caution. If you decide to reinstate the routing capabilities, you must reconfigure the device from scratch.

From the **Main Menu**, select **System Configuration**.



Select **Change Device to a Bridge** and press **Return**. You will be challenged to confirm this choice.



If you chose **CONTINUE**, the device will reboot and restart in bridge mode. Routing features will be disabled and the console menus corresponding configuration items, such as Easy Setup, will be removed.

```

Netopia Router

WAN Configuration...
System Configuration...
Utilities & Diagnostics...
Statistics & Logs...
Quick View...

```

You can reinstate router mode by returning to the System Configuration menu.

```

System Configuration

Management IP Setup...
Filter Sets...

Date and Time...

Console Configuration...
SNMP (Simple Network Management Protocol)...

Security...

Upgrade Feature Set...

Change Device to a Router... ←
Logging...

Use this screen if you want options beyond Easy Setup.

```

Select **Change Device to a Router**.

Press **Return**, confirm your choice, and the device will restart in router mode.

**Bridged Frame-Relay. Note:** Netopia Firmware Version 5.4 now supports additional Frame Relay configuration options when the Netopia device is operating in bridged mode.

Bridged Frame Relay (RFC 2427) is an extension of the existing onboard Frame Relay capability. Frame Relay-capable Netopia routers (ex: T-1, IDSL) may be run in bridged mode, with the WAN handling Frame Relay packets that are bridged to the Ethernet interface. For these models, LMI, multiple DLCIs, etc. can be configured.

If you choose to run the router in bridged mode, and select Frame Relay as the data link encapsulation method in the WAN (Wide Area Network) Setup menu, the WAN Configuration menu now offers options to configure Frame Relay and Frame Relay DLCIs.

## Logging

You can configure a UNIX-compatible syslog client to report a number of subsets of the events entered in the router's WAN Event History. See "WAN Event History" on page 9-5.

Select **Logging** from the System Configuration menu.

The Logging Configuration screen appears.

Logging Configuration

WAN Event Log Options	
Log Boot and Errors:	Yes
Log Line Specific:	Yes
Log Connections:	Yes
Log PPP, DHCP, CNA:	Yes
Log IP:	Yes
Syslog Parameters	
Syslog Enabled:	No
Hostname or IP Address:	
Facility...	Local 0

By default, all events are logged in the event history.

- By toggling each event descriptor to either **Yes** or **No**, you can determine which ones are logged and which are ignored.
- You can enable or disable the syslog client dynamically. When enabled, it will report any appropriate and previously unreported events.
- You can specify the syslog server's address either in dotted decimal format or as a DNS name up to 63 characters.
- You can specify the UNIX syslog Facility to use by selecting the **Facility** pop-up.
- Erase the log by selecting DUMP WAN LOG

You will need to install a Syslog client daemon program on your PC and configure it to report the WAN events you specified in the Logging Configuration screen.

The following screen shows a sample syslog dump of WAN events:

```

May 5 10:14:06 tsnext.netopia.com Link 1 down: PPP PAP failure
May 5 10:14:06 tsnext.netopia.com >>Issued Speech Setup Request from our DN: 5108645534
May 5 10:14:06 tsnext.netopia.com Requested Disc. from DN: 917143652500
May 5 10:14:06 tsnext.netopia.com Received Clear Confirm for our DN: 5108645534
May 5 10:14:06 tsnext.netopia.com Link 1 down: Manual disconnect
May 5 10:14:06 tsnext.netopia.com >>Issued Speech Setup Request from our DN: 5108645534
May 5 10:14:06 tsnext.netopia.com Requested Disc. from DN: 917143652500
May 5 10:14:06 tsnext.netopia.com Received Clear Confirm for our DN: 5108645534
May 5 10:14:06 tsnext.netopia.com Link 1 down: No answer
May 5 10:14:06 tsnext.netopia.com -----Device restarted-----
May 5 10:14:06 tsnext.netopia.com >>Received Speech Setup Ind. from DN: (not supplied)
May 5 10:14:06 tsnext.netopia.com Requested Connect to our DN: 5108645534
May 5 10:14:06 tsnext.netopia.com ASYNC: Modem carrier detected (more) Modem
reports: 26400 V34
May 5 10:14:06 tsnext.netopia.com >>WAN: 56K Modem 1 activated at 115 Kbps
May 5 10:14:06 tsnext.netopia.com Connect Confirmed to our DN: 5108645534
May 5 10:14:06 tsnext.netopia.com PPP: Channel 1 up, Answer Profile name: Default Profile
May 5 10:14:06 tsnext.netopia.com PPP: NCP up, session 1, Channel 1 Final (fallback)
negotiated auth: Local PAP , Remote NONE
May 5 10:14:06 tsnext.netopia.com PPP: PAP we accepted remote, Channel 1 Remote name: guest
May 5 10:14:06 tsnext.netopia.com PPP: MP negotiated, session 1 Remote EDO: 06 03 0
000C5700624 0
May 5 10:14:06 tsnext.netopia.com PPP: CCP negotiated, session 1, type: Ascend
LZS Local mode: 1, Remote mode: 1
May 5 10:14:06 tsnext.netopia.com PPP: BACP negotiated, session 1 Local MN: FFFFFFFF
FF, Remote MN: 00000001
May 5 10:14:06 tsnext.netopia.com PPP: IPCP negotiated, session 1, rem:
192.168.10.100 local: 192.168.1.1
May 5 10:14:06 tsnext.netopia.com >>WAN: 56K Modem 1 deactivated
May 5 10:14:06 tsnext.netopia.com Received Clear Ind. from DN: 5108645534, Cause: 0
May 5 10:14:06 tsnext.netopia.com Issued Clear Response to DN: 5108645534
May 5 10:14:06 tsnext.netopia.com Link 1 down: Remote clearing
May 5 10:14:06 tsnext.netopia.com PPP: IPCP down, session 1
May 5 10:14:06 tsnext.netopia.com >>Received Speech Setup Ind. from DN: (not supplied)

```



## Chapter 3

# Multiple Network Address Translation

Netopia Firmware Version 5.4 offers advanced Multiple Network Address Translation functionality.

You should read this chapter completely before attempting to configure any of the advanced NAT features.

This chapter covers the following topics:

- [Overview on page 3-1](#)
- [MultiNAT Configuration on page 3-6](#)
- [Easy Setup Profile configuration on page 3-6](#)
- [Server Lists and Dynamic NAT configuration on page 3-7](#)
- [Adding Server Lists on page 3-15](#)
- [Binding Map Lists and Server Lists on page 3-21](#)
- [NAT Associations on page 3-25](#)
- [IP Passthrough on page 3-27](#)
- [MultiNAT Configuration Example on page 3-31](#)

---

## Overview

NAT (Network Address Translation) is a means of mapping one or more IP addresses and/or IP service ports into different values. This *mapping* serves two functions:

- It allows the addresses of many computers on a LAN to be represented to the public Internet by only one or a few addresses, saving you money.
- It can be used as a security feature by obscuring the true addresses of important machines from potential hackers on the Internet.

To help you understand some of the concepts discussed here, it may be helpful to introduce some NAT terminology.

The term *mapping* refers to rules that associate one or more private addresses on the Netopia Router's LAN to one or more public addresses on the Netopia Routers WAN interface (typically the Internet).

The terms *private* and *internal* refer to addresses on the Netopia Router's LAN. These addresses are considered private because they are protected or obscured by NAT and cannot be directly accessed from the WAN (or Internet) side of the Netopia Router unless specifically configured otherwise.

The terms *public* and *external* refer to the WAN (or Internet) side of the Netopia Router.

# Features

MultiNAT features can be divided into several categories that can be used simultaneously in different combinations on a per-Connection Profile basis.

The following is a general description of these features:

## ***Port Address Translation***

The simplest form of classic Network Address Translation is *PAT* (Port Address Translation). *PAT* allows a group of computers on a LAN, such as might be found in a home or small office, to share a single Internet connection using one IP address. The computers on the LAN can surf the Web, read e-mail, download files, etc., but their individual IP addresses are never exposed to the public network. Instead, a single IP address acts as the source IP address of traffic originating from the LAN. The Netopia Router allows you to define multiple *PAT* mappings, which can be individually mapped to different public IP addresses. This offers more control over the access permitted to users on the LAN.

A limitation of *PAT* is that communication must be initiated from the internal network. A user on the external side cannot access a machine behind a *PAT* connection. A *PAT* enhancement is the ability to define multiple *PAT* mappings. Each of these can optionally map to a section or *range* of IP addresses of the internal network. *PAT* mapping allows only internal users to initiate traffic flow between the internal and external networks.

## ***Server lists***

*Server lists*, previously known as exported services, make it possible to provide access from the public network to hosts on the LAN. *Server lists* allow you to define particular services, such as Web, ftp, or e-mail, which are available via a public IP address. You define the type of service you would like to make available and the internal IP address to which you would like to provide access. You may also define a specific public IP address to use for this service if you want to use an IP other than the WAN IP address of the Netopia Router.

## ***Static mapping***

If you want to host your own Website or provide other Internet services to the public, you need more than classic NAT. The reason is noted under Port Address Translation above – external users cannot initiate traffic to computers on your LAN because external users can never see the real addresses of the computers on your LAN. If you want users outside your LAN to have access, for example, to a Web or FTP server that you host, you need to make a public representation of the real IP addresses of those servers.

*Static mappings* are a way to make one or more private IP addresses fully accessible from the public network via corresponding public IP addresses. Some applications may negotiate multiple TCP connections in the process of communication, which often does not work with traditional *PAT*. *Static mapping* offers the ability to use these applications through NAT. Each private IP address is mapped, on a one-to-one basis, to a public IP address that can be accessed from the Internet or public network. As with *PAT* mappings, you may have multiple *static mappings* to map a range of private IP addresses to a range of public IP addresses if desired.

## Dynamic mapping

*Dynamic mapping*, often referred to as many-to-few, offers an extension to the advantages provided by static mapping. Instead of requiring a one-to-one association of public addresses and private addresses, as is required in static mapping, dynamic mapping uses a group of public IP addresses to dynamically allocate static mappings to private hosts that are communicating with the public network. If a host on the private network initiates a connection to the Internet, for example, the Netopia Router automatically sets up a one-to-one mapping of that host's private IP address to one of the public IP addresses allocated to be used for Dynamic NAT. As long as this host is communicating with the Internet, it will be able to use that address. When traffic from that host ceases, and no traffic is passed from that host for five minutes, the public address is made available again for other private hosts to use as necessary.

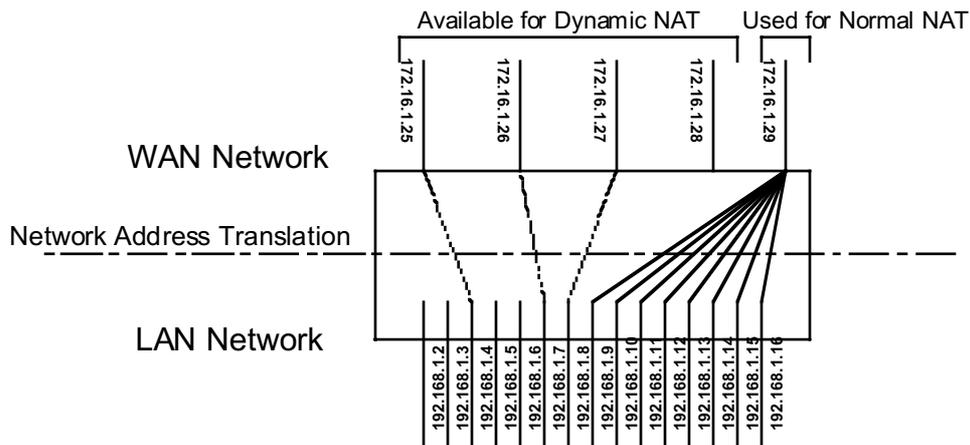
When addresses are returned to the group of available addresses, they are returned to the head of the group, being the most recently used. If that same host requests a connection an hour later, and the same public address is still available, then it will be mapped to the same private host. If a new host, which has not previously requested a connection, initiates a connection it is allocated the last, or oldest, public address available.

Dynamic NAT is a way of sharing a range of public, or exterior, NAT addresses among one or more *groups* of private, or interior, hosts. This is intended to provide superior support for applications that traditionally have difficulty communicating through NAT. Dynamic NAT is intended to provide functionality beyond many-to-one and one-to-one translation. Netopia's NAT implementation makes it possible to have a static mapping of one public address to one private address, thus allowing applications such as NetMeeting to work by assuring that any traffic sent back to the source IP address is forwarded through to the internal machine.

Static one-to-one mapping works well if you have enough IP addresses for all the workstations on your LAN. If you do not, Dynamic NAT allows machines to make full use of the publicly routable IP addresses provided by the ISP as necessary, on demand. When these public IP addresses are no longer being used by a particular workstation, they are returned to a pool of available addresses for other workstations to use.

A common example is a DSL customer's application. Most DSL ISPs only provide customers with a few IP addresses for use on their network. For networks with more than four or five machines it is usually mandatory to use NAT. A customer may have 15 workstations on the LAN, all of which need Internet access. The customer is only provided five IP addresses by their ISP. The customer has eight hosts, which only need to use email and have Web access, but another seven hosts, which use NetMeeting to communicate with clients once or twice a day. NetMeeting will not work unless a static one-to-one mapping exists for the machine running NetMeeting to use for communication. The customer does not have enough IP addresses to create a one-to-one mapping for each of the seven users. This is where dynamic NAT applies.

The customer can configure four of these addresses to be used for Dynamic NAT. The fifth address is then used for the eight other machines that do not need one-to-one mappings. As each machine configured to use addresses from the dynamic pool tries to connect to the Internet it is allocated a public IP address to use temporarily. Once the communication has been terminated, that IP address is freed for one of the other six hosts to use.



Exterior addresses are allocated to internal hosts on a demand, or as-needed, basis and then made available when traffic from that host ceases. Once an internal host has been allocated an address, it will use that address for all traffic. Five minutes after all traffic ceases – no pings, all TCP connections closed, no DNS requests, etc. – the address is put at the head of an *available* list. If an interior host needs an exterior address an hour later, and the previously used address is still available, it will acquire the same address. If an interior host that has not previously been allocated an exterior address needs one, it will be allocated the last, hence the oldest, exterior address on the available list.

All NAT configurations are *rule-based*. This means that traffic passed through NAT from either the public or the private network is compared to the rules and mappings configured in the Netopia Router in a particular order. The first rule that applies to the traffic being initiated is used.

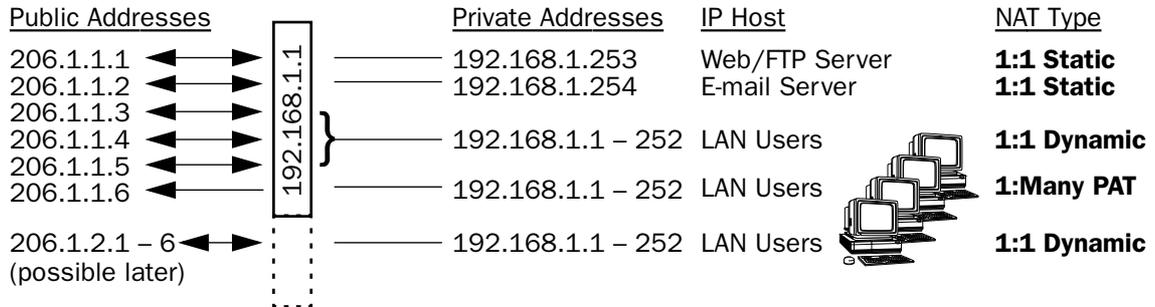
For example, if a connection is initiated from the public network and is destined for a public IP address configured on the Netopia Router, the following comparisons are made in this order.

1. The Netopia Router first checks its internal NAT cache to see if the data is part of a previously initiated connection, if not...
2. The Netopia Router checks the configured server lists to see if this traffic is intended to be forwarded to an internal host based on the type of service.
3. The Netopia Router then checks to see if there is a static, dynamic, or PAT mapping for the public IP address that the connection is being initiated to.
4. The Netopia Router answers the request itself if the data is destined for the Netopia's WAN interface IP address. Otherwise the data is discarded.

## Complex maps

Map lists and server lists are completely independent of each other. A Connection Profile can use one or the other or both.

MultiNAT allows complex mapping and requires more complex configuration than in earlier firmware versions. Multiple mapped interior subnets are supported, and the rules for mapping each of the subnets may be different. The figure below illustrates a possible multiNAT configuration.



In order to support this type of mapping, you define two address ranges. First, you define a public range which contains the first and last public address to be used and the way in which these addresses should be used (PAT, static, or dynamic). You then configure an address map which defines the private IP address or addresses to be used and which public range they should be mapped to. You add the address map to the list of address maps which are configured, creating a map list. The mappings in the map list are order-dependent and are compared in order from the top of the list to the bottom. If a particular resource is not available, subordinate mappings can be defined that will redirect traffic.

## Supported traffic

MultiNat supports the following IP protocols:

- PAT: TCP/UDP traffic which does not carry source or destination IP addresses or ports in the data stream (i.e., HTTP, Telnet, 'r' commands, tftp, NFS, NTP, SMTP, NNTP, etc.).
- Static NAT: All IP protocol traffic which does not carry or otherwise rely on the source or destination IP addresses in the data stream.
- Dynamic NAT: All IP protocol traffic which does not carry or otherwise rely on the source or destination IP addresses in the data stream.

## Support for Microsoft Network (MSN) Messenger

Netopia Firmware Version 5.4 provides support for MSN Messenger/Windows Messenger applications via UPnP (see [UPnP Support on page 10-2](#)). Normal plain chat always works.

## Support for AOL Instant Messenger (AIM) File Transfer

Netopia Firmware Version 5.4 provides Application Level Gateway (ALG) support for AOL Instant Messenger (AIM) file transfer. This allows AIM users to exchange files, even when both users are behind NAT. Previously, the file transfer function would work only if one or neither of the two users were behind NAT.

Currently there is a restriction that the remote user must be routed to via the WAN interface, otherwise the connections will fail. There is no restriction as to the number of connections.

There is no user configuration required for this feature.

---

## MultiNAT Configuration

You configure the MultiNAT features through the console menu:

- For a simple 1-to-many NAT configuration (classic NAT or PAT), use the [Easy Setup Profile configuration](#), described below.
- For the more advanced features, such as server lists and dynamic NAT, follow the instructions in:
  - [IP setup](#), described on [page 3-7](#)
  - [IP profile parameters](#), described on [page 3-21](#)

### Easy Setup Profile configuration

The screen below is an example. Depending on the type of router you are using, fields displayed in this screen may vary.

```
Connection Profile 1: Easy Setup Profile

Connection Profile Name:      Easy Setup Profile

Address Translation Enabled:  Yes
IP Addressing...            Numbered

Local WAN IP Address:        0.0.0.0
Local WAN IP Mask:           255.255.255.0
Remote IP Address:           127.0.0.2
Remote IP Mask:              255.255.255.255

PPP Authentication...        PAP
Send User Name:              tonyf
Send Password:                *****

PREVIOUS SCREEN              NEXT SCREEN

Return/Enter brings you to next screen.
```

The **Local WAN IP Address** is used to configure a NAT public address range consisting of the Local WAN IP Address and all its ports. The public address map list is named *Easy-PAT List* and the port map list is named *Easy-Servers*.

The two map lists, Easy-PAT List and Easy-Servers, are created by default and NAT configuration becomes effective. This will map all your private addresses (0.0.0.0 through 255.255.255.255) to your public address. These map lists are bound to the Easy Setup Profile. See [Binding Map Lists and Server Lists on page 3-21](#).

This is all you need to do if you want to continue to use a single PAT, or 1-to-many, NAT configuration.

## Server Lists and Dynamic NAT configuration

You use the advanced NAT feature sets by first defining a series of mapping rules and then grouping them into a *list*. There are two kinds of lists – *map lists*, made up of dynamic, PAT and static mapping rules, and *server lists*, a list of internal services to be presented to the external world. Creating these lists is a four-step process:

1. **Define the public range** of addresses that external computers should use to get to the NAT internal machines. These are the addresses that someone on the Internet would see.
2. **Create a List name** that will act as a rule or server holder.
3. **Create a map or rule** that specifies the internal range of NATed addresses and the external range they are to be associated with.
4. **Associate the Map or Server List to your WAN interface** via a Connection Profile or the Default Profile.

The three NAT features all operate completely independently of each other, although they can be used simultaneously on the same Connection Profile.

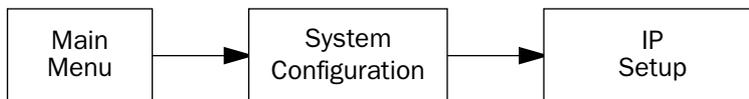
You can configure a simple 1-to-many PAT (often referred to simply as NAT) mapping using Easy Setup. More complex setups require configuration using the **Network Address Translation** item on the IP Setup screen.

An example MultiNAT configuration at the end of this chapter describes some applications for these features. See the [MultiNAT Configuration Example on page 3-31](#).

In order to configure the router to make servers on your LAN visible to the Internet, you use advanced features in the System Configuration screens, described in [IP setup](#).

## IP setup

To access the NAT configuration screens, from the Main Menu navigate to IP Setup:



```

                                IP Setup

Ethernet IP Address:             192.168.1.1
Ethernet Subnet Mask:          255.255.255.0
Define Additional Subnets...

Default IP Gateway:            127.0.0.2

Primary Domain Name Server:    0.0.0.0
Secondary Domain Name Server:  0.0.0.0
Domain Name:                   isp.com

Receive RIP...                 Both
Transmit RIP...                Off

Static Routes...               IP Address Serving...
Network Address Translation (NAT)...

Set up the basic IP attributes of your Netopia in this screen.
```

Select **Network Address Translation (NAT)** and press Return.

The Network Address Translation screen appears.

```

                                Network Address Translation

Add Public Range...
Show/Change Public Range...
Delete Public Range...

Add Map List...
Show/Change Map List...
Delete Map List...

Add Server List...
Show/Change Server List...
Delete Server List...

NAT Associations...

Return/Enter to configure IP Address redirection.
```

**Public Range** defines an external address range and indicates what type of mapping to apply when using this range. The types of mapping available are *dynamic*, *static* and *pat*.

**Map Lists** define collections of mapping rules. A rule maps interior range addresses to exterior range addresses by the mapping techniques defined in the map list.

**Server Lists** bind internal IP addresses and ports to external IP addresses and ports so that connections initiated from the outside can access an interior server.

## NAT rules

The following rules apply to assigning NAT ranges and server lists:

- Static public address ranges must not overlap other static, PAT, public addresses, or the public address assigned to the router's WAN interface.
- A PAT public address must not overlap any static address ranges. It may be the same as another PAT address or server list address, but the port range must not overlap.

You configure the ranges of exterior addresses by first adding public ranges.

Select **Add Public Range** and press Return.

The Add NAT Public Range screen appears.

Add NAT Public Range

Range Name:	my_first_range
Type...	pat
Public Address:	206.1.1.6
First Public Port:	49152
Last Public Port:	65535
ADD NAT PUBLIC RANGE	CANCEL

- Select **Range Name** and give a descriptive name to this range.
- Select **Type** and from the pop-up menu, assign its type. Options are **static**, **dynamic**, or **pat** (the default).
  - If you choose **pat** as the range type, select **Public Address** and enter the exterior IP address in the range you want to assign. Select **First** and **Last Public Port** and enter the first and last exterior ports in the range. These are the ports that will be used for traffic initiated from the private LAN to the outside world.

**Note:** For PAT map lists and server lists, if you use the Public Address 0.0.0.0, the list will acquire its public IP address from the WAN IP address specified by your WAN IP configuration in the Connection Profile. If that is a static IP address, then the PAT map list and server lists will acquire that address. If it is a negotiated IP address, such as may be assigned via DHCP or PPP, the PAT map list and server lists will acquire that address each time it is negotiated.

- If you choose **dynamic** as the range type, a new menu item, **First Public Address**, becomes visible. Select **First Public Address** and enter the first exterior IP address in the range you want to assign. Select **Last Public Address** and enter an IP address at the end of the range.
- If you choose **static** as the range type, a new menu item, **First Public Address**, becomes visible.

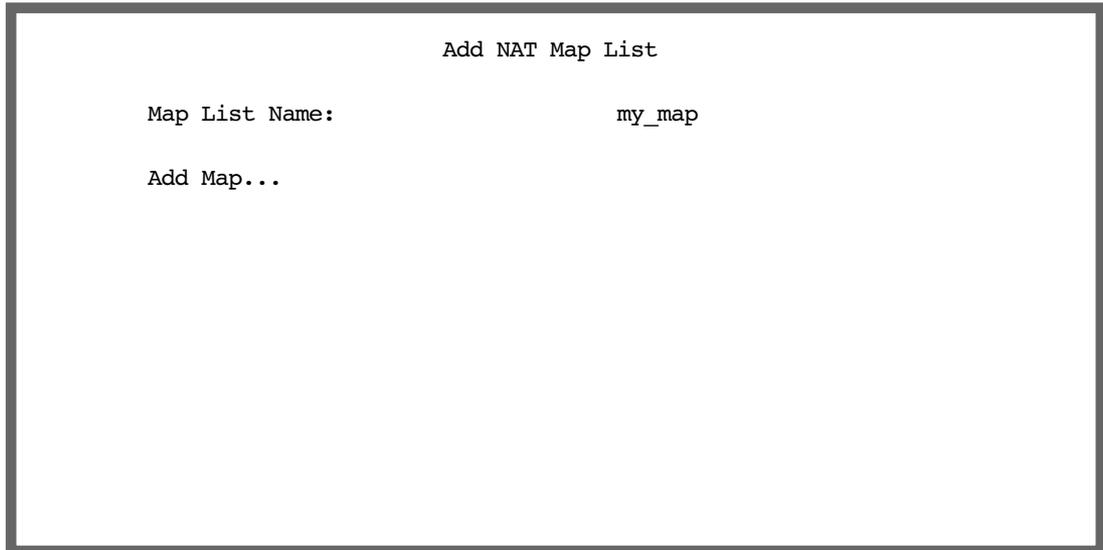
Select **First Public Address** and enter the first exterior IP address in the range you want to assign.  
Select **Last Public Address** and enter an IP address at the end of the range.

- Select **ADD NAT PUBLIC RANGE** and press Return. The range will be added to your list and you will be returned to the Network Address Translation screen.

Once the public ranges have been assigned, the next step is to bind interior addresses to them. Because these bindings occur in ordered lists, called *map lists*, you must first define the list, then add mappings to it.

From the Network Address Translation screen select **Add Map List** and press Return.

The Add NAT Map List screen appears.



```

Add NAT Map List

Map List Name:          my_map

Add Map...
```

- Select **Map List Name** and enter a descriptive name for this map list. A new menu item, **Add Map**, appears.

- Select **Add Map** and press Return. The Add NAT Map screen appears.

```

Add NAT Map ("my_map")

First Private Address:      192.168.1.1
Last Private Address:      192.168.1.254

Use NAT Public Range...

ADD NAT MAP                CANCEL

```

- Select **First** and **Last Private Address** and enter the first and last interior IP addresses you want to assign to this mapping.
- Select **Use NAT Public Range** and press Return. A screen appears displaying the public ranges you have defined.

```

Add NAT Map ("my_map")
+-Public Address Range-----Type-----Name-----+
+-----+-----+-----+-----+-----+-----+
| 0.0.0.0      --          pat      Easy-PAT      |
| 206.1.1.6    --          pat      my_first_range  |
| 206.1.1.1    206.1.1.2  static   my_second_range |
| <<NEW RANGE...>>                                     |
+-----+-----+-----+-----+-----+-----+

```

**Select** ←

Up/Down Arrow Keys to select, ESC to cancel, Return/Enter to Delete.

- From the list of public ranges you defined, select the one that you want to map to the interior range for this

mapping and press Return.

If none of your preconfigured ranges are suitable for this mapping, you can select **<<NEW RANGE>>** and create a new range. If you choose **<<NEW RANGE>>**, the Add NAT Public Range screen displays and you can create a new public range to be used by this map. See [Add NAT Public Range on page 3-9](#).

- The Add NAT Map screen now displays the range you have assigned.

```

                                Add NAT Map ("my_map")

First Private Address:           192.168.1.1
Last Private Address:           192.168.1.254

Use NAT Public Range...         my_first_range
    Public Range Type is:       pat
    Public Range Start Address is: 206.1.1.6

                                ADD NAT MAP                CANCEL
```

- Select **ADD NAT MAP** and press Return. Your mapping is added to your map list.

## Modifying map lists

You can make changes to an existing map list after you have created it. Since there may be more than one map list you must select which one you are modifying.

From the Network Address Translation screen select **Show/Change Map List** and press Return.

- Select the map list you want to modify from the pop-up menu.

```

Network Address Translation
+-NAT Map List Name--+
+-----+
Add Out Easy-PAT List
Show/Ch my_map
Delete
Add Map
Show/Ch
Delete
Add Ser
Show/Ch
Delete
NAT Ass

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

The Show/Change NAT Map List screen appears.

```

Show/Change NAT Map List

Map List Name:          my_map

Add Map...
Show/Change Maps...
Delete Map...

```

- **Add Map** allows you to add a new map to the map list.
- **Show/Change Maps** allows you to modify the individual maps within the list.
- **Delete Map** allows you to delete a map from the list.

Selecting **Show/Change Maps** or **Delete Map** displays the same pop-up menu.

```

                                Show/Change NAT Map List
+---Private Address Range-----Type-----Public Address Range-----+
| 192.168.1.1      192.168.1.254  pat    206.1.1.6      --
| 192.168.1.253   192.168.1.254  static 206.1.1.1      206.1.1.2
| 192.168.1.1      192.168.1.252  dynamic 206.1.1.3      206.1.1.5
+-----+-----+-----+-----+

```

Scroll to the map you want to modify using the arrow keys and press Return.

The Change NAT Map screen appears.

```

                                Change NAT Map ("my_map")

First Private Address:           192.168.1.253
Last Private Address:           192.168.1.254

Use NAT Public Range...         my_second_range
Public Range Type is:           static
Public Range Start Address is:  206.1.1.1
Public Range End Address is:    206.1.1.2

CHANGE NAT MAP                   CANCEL

```

Make any modifications you need and then select **CHANGE NAT MAP** and press Return. Your changes will become effective and you will be returned to the Show/Change NAT Map List screen.

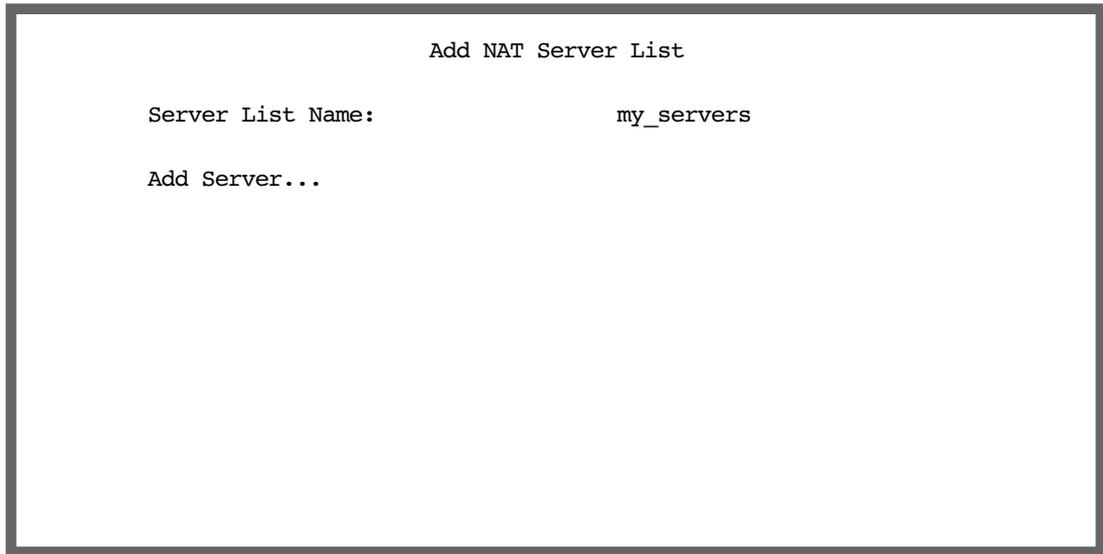
---

## Adding Server Lists

Server lists, also known as Exports, are handled similarly to map lists. If you want to make a particular server's port accessible (and it isn't accessible through other means, such as a static mapping), you must create a server list.

Select **Add Server List** from the Network Address Translation screen.

The Add NAT Server List screen appears.



Add NAT Server List

Server List Name:                    my\_servers

Add Server...

- Select **Server List Name** and type in a descriptive name. A new menu item, **Add Server**, appears.

- Select **Add Server** and press Return. The Add NAT Server screen appears.

```

                                Add NAT Server ("my_servers")

Service...
Server Private IP Address:      192.168.1.45
Public IP Address:             206.1.1.1

                                ADD NAT SERVER                CANCEL

```

- Select **Service** and press Return. A pop-up menu appears listing a selection of commonly exported services.

```

                                Add NAT Server ("my_servers")
                                +-Type-----Port(s)-----+
Service...
Server Private IP Address:
Public IP Address:
                                ftp      21
                                telnet   23
                                smtp      25
                                tftp     69
                                gopher   70
                                finger    79
                                www-http  80
                                pop2     109
                                pop3     110
                                snmp     161 - 162
                                timbuktu 407
                                pptp     1723
                                irc      6665 - 6669
                                Other...
                                +-----+
                                ADD NAT SERVER                CANCEL

```

- Choose the service you want to export and press Return.

You can choose a preconfigured service from the list, or define your own by selecting **Other**. If you select **Other**, a screen is displayed that allows you to enter the port number range for your customized service.

Other Exported Port	
First Port Number (1..65535):	31337
Last Port Number (1..65535):	31337
<p style="text-align: center;">OK <span style="margin-left: 150px;">CANCEL</span></p>	

- Enter the **First** and **Last Port Number** between ports 1 and 65535. Select **OK** and press Return. You will be returned to the Add NAT Server screen.
  - Enter the **Server Private IP Address** of the server whose service you are exporting.  
 Since MultiNAT permits the mapping of multiple private IP addresses to multiple public IP addresses, your ISP or corporate site's router must be configured such that it knows that your multiple public addresses are accessible via your router.  
 If you want to use static mappings to map internal servers to public addresses, your ISP or corporate site's router must also be configured for static routes to these public addresses on the Netopia Router.
  - Enter the **Public IP Address** to which you are exporting the service.
- Note:** For PAT map lists and server lists, if you use the Public Address 0.0.0.0, the list will acquire its public IP address from the WAN IP address specified by your WAN IP configuration in the Connection Profile. If that is a static IP address, then the PAT map list and server lists will acquire that address. If it is a negotiated IP address, such as may be assigned via DHCP or PPP, the PAT map list and server lists will acquire that address each time it is negotiated.
- Select **ADD NAT SERVER** and press Return. The server will be added to your server list and you will be returned to the Add NAT Server List screen.

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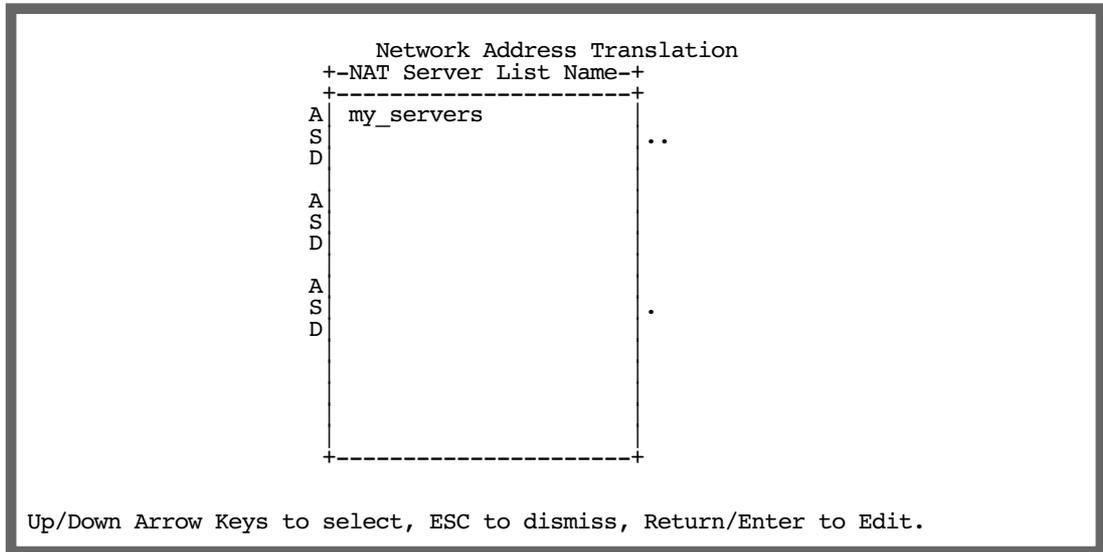
**Note:** In order to use **CUSeeMe** through the Netopia Router, you must export the ports 7648 and 7649. In MultiNat, you may use a port range export. Without the export, CUSeeMe will fail to work. This is true unless a static mapping is in place for the host using CUSeeMe. In that case no server list entry is necessary.

---

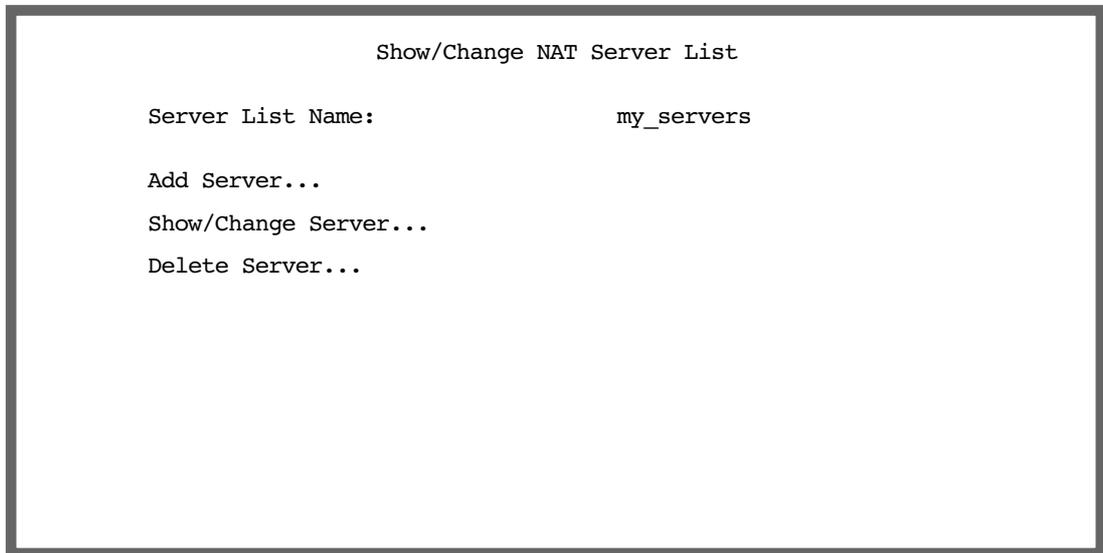
## Modifying server lists

Once a server list exists, you can select it for modification or deletion.

- Select **Show/Change Server List** from the Network Address Translation screen.
- Select the Server List Name you want to modify from the pop-up menu and press Return.



The Show/Change NAT Server List screen appears.



- Selecting **Show/Change Server** or **Delete Server** displays the same pop-up menu.

```

                                Show/Change NAT Server List
          +-Private Address--Public Address---Port-----+
          +-----+-----+-----+
Se  192.168.1.254   206.1.1.6       smtp
     192.168.1.254   206.1.1.5       smtp
     192.168.1.254   206.1.1.4       smtp
Ad  192.168.1.254   206.1.1.3       smtp
     192.168.1.254   206.1.1.1       smtp
Sh
De
          +-----+-----+-----+
Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

Select any server from the list and press Return. The Change NAT Server screen appears.

```

                                Change NAT Server ("My Exports")

Service...                               smtp
Server Private IP Address:               192.168.1.254
Public IP Address:                       206.1.1.1

CHANGE NAT SERVER                         CANCEL

```

You can make changes to the server's service and port or internal or external address.

Select **CHANGE NAT SERVER** and press Return. Your changes take effect and you are returned to the Show/Change NAT Server List screen.

## Deleting a server

To delete a server from the list, select **Delete Server** from the Show/Change NAT Server List menu and press Return.

A pop-up menu lists your configured servers. Select the one you want to delete and press Return. A dialog box asks you to confirm your choice.

```

                                Show/Change NAT Server List
+--Internal Address-External Address--Port-----+
|
| Se | 192.168.1.254   206.1.1.6   smtp
| 19+-----+
| 19+-----+
| Ad | Are you sure you want to delete this Server?
| Sh |          CANCEL                CONTINUE
| De |
|
+-----+

```

Choose **CONTINUE** and press Return. The server is deleted from the list.

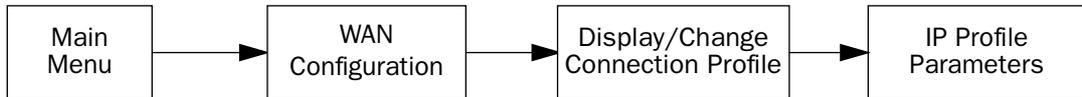
## Binding Map Lists and Server Lists

Once you have created your map lists and server lists, for most Netopia Router models you must bind them to a profile, either a Connection Profile or the Default Profile. You do this in one of the following screens:

- the [IP profile parameters](#) screen (see below) of the Connection Profile configuration menu
- the [IP Parameters \(WAN Default Profile\)](#) screen (see [page 3-23](#)) of the Default Profile configuration menu
- the [Binding Map Lists and Server Lists](#) screen (see [page 3-21](#))

### IP profile parameters

To bind a map list to a Connection Profile, from the Main Menu go to the WAN Configuration screen then the Display/Change Connection Profile screen. From the pop-up menu list of your Connection Profiles, choose the one you want to bind your map list to. Select **IP Profile Parameters** and press Return.



The IP Profile Parameters screen appears.

```

IP Profile Parameters

Address Translation Enabled:      Yes
IP Addressing...                 Unnumbered

NAT Map List...                  Easy-PAT List
NAT Server List...              Easy-Servers

Local WAN IP Address:           206.1.1.6
Local WAN IP Mask:              0.0.0.0
Remote IP Address:              127.0.0.2
Remote IP Mask:                 255.255.255.255

Filter Set...                    Basic Firewall
Remove Filter Set

RIP Profile Options...

Configure IP requirements for a remote network connection here.
  
```

- Select **NAT Map List** and press Return. A pop-up menu displays a list of your defined map lists.

```

                                IP Profile Parameters
                                +--NAT Map List Name--+
                                +-----+
Address Trans  Easy-PAT          s
IP Addressing my_map           mbered
                                <<None>>
NAT Map List. sy PAT
NAT Server Li
Local WAN IP
Remote IP Add 7.0.0.2
Remote IP Mas 5.255.255.255
Filter Set... tBIOS Filter
Remove Filter
Receive RIP:  th
                                +-----+
Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

- Select the map list you want to bind to this Connection Profile and press Return. The map list you selected will now be bound to this Connection Profile.
- Select **NAT Server List** and press Return. A pop-up menu displays a list of your defined server lists.

```

                                IP Profile Parameters
                                +--NAT Server List Name--+
                                +-----+
Address Trans  Easy-Servers      s
IP Addressing my_servers       mbered
                                <<None>>
NAT Map List. sy PAT
NAT Server Li
Local WAN IP  0.0.0
Local WAN IP  0.0.0
Remote IP Add 7.0.0.2
Remote IP Mas 5.255.255.255
Filter Set... tBIOS Filter
Remove Filter
Receive RIP:  th
                                +-----+
Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

- Select the server list you want to bind to this Connection Profile and press Return. The server list you selected will now be bound to this Connection Profile.

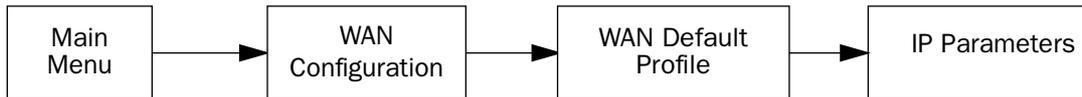
**Note:** There is no interdependency between NAT and IP Addressing. Also, the Local WAN IP Address and Mask fields' visibility are dependent only on the IP Addressing type.

## IP Parameters (WAN Default Profile)

The Netopia Firmware Version 5.4 using RFC 1483 supports a WAN default profile that permits several parameters to be configured without an explicitly configured Connection Profile.

The procedure is similar to the procedure to bind map lists and server lists to a Connection Profile.

From the Main Menu go to the WAN Configuration screen, then the Default Profile screen. Select **IP Parameters** and press Return.



The IP Parameters (Default Profile) screen appears.

```

IP Parameters (Default Profile)

Address Translation Enabled:      Yes
NAT Map List...                  Easy-PAT List
NAT Server List...              Easy-Servers

Filter Set (Firewall)...
Remove Filter Set

Receive RIP:                      Both

Return/Enter to select <among/between> ...
  
```

- Toggle **Address Translation Enabled** to Yes.

- Select **NAT Map List** and press Return. A pop-up menu displays a list of your defined map lists.

```

                                IP Parameters (Default Profile)
                                +--NAT Map List Name---+
                                +-----+
                                Easy-PAT List
                                my_map
                                <<None>>
Address Trans                    s
NAT Map List.
NAT Server Li
Filter Set (F
Remove Filter
Receive RIP:                    th
                                +-----+
    
```

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

- Select the map list you want to bind to the default profile and press Return. The map list you selected will now be bound to the default profile.
- Select **NAT Server List** and press Return. A pop-up menu displays a list of your defined server lists.

```

                                IP Parameters (Default Profile)
                                +--NAT Server List Name--+
                                +-----+
                                Easy-Servers
                                my_servers
                                <<None>>
Address Trans                    s
NAT Map List.
NAT Server Li                    _first_map
Filter Set (F
Remove Filter
Receive RIP:                    th
                                +-----+
    
```

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

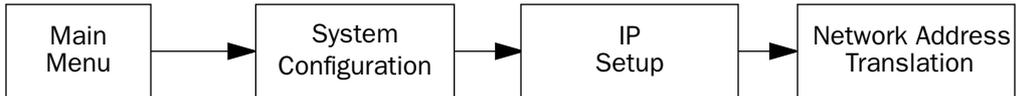
- Select the server list you want to bind to the default profile and press Return. The server list you selected will now be bound to the default profile.

**Note:** There is no interdependency between NAT and IP Addressing. Also, the Local WAN IP Address and Mask fields' visibility are dependent only on the IP Addressing type.

## NAT Associations

Configuration of map and server lists alone is not sufficient to enable NAT for a WAN connection because map and server lists must be linked to a profile that controls the WAN interface. This can be a Connection Profile, a WAN Ethernet interface, a default profile, or a default answer profile. Once you have configured your map and server lists, you may want to reassign them to different interface-controlling profiles, for example, Connection Profiles. To permit easy access to this IP Setup functionality, you can use the NAT Associations screen.

You access the NAT Associations screen from the Network Address Translation screen.



Select **NAT Associations** and press Return. The NAT Associations screen appears.

NAT Associations			
Profile/Interface Name-----	Nat?-----	Map List Name-----	Server List Name
Default Answer Profile	On	my_first_map	my_servers
Easy Setup Profile	On	Easy-PAT	my_servers
Profile 01	On	my_second_map	my_servers
Profile 02	On	my_first_map	my_server_list
Profile 03	On	<<None>>	<<None>>

- You can toggle **NAT? On** or **Off** for each Profile/Interface name. You do this by navigating to the **NAT?** field associated with each profile using the arrow keys. Toggle NAT on or off by using the Tab key.
- You can reassign any of your map lists or server lists to any of the Profile/Interfaces. You do this by navigating to the **Map List Name** or **Server List Name** field associated with each profile using the arrow

keys. Select the item by pressing Return to display a pop-up menu of all of your configured lists.

NAT Associations			
Profile/Interface Name-----	Nat	+NAT Map List Name-+	Server List Name
Easy Setup Profile	On	Easy-PAT List	my_servers
Profile 01	On	my_first_map	my_servers
Profile 02	On	my_second_map	my_server_list
Profile 03	On	my_map	<<None>>
Profile 04	On	<<None>>	<<None>>
Default Answer Profile	On	-----	my_servers

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

- Select the list name you want to assign and press Return again. Your selection will then be associated with the corresponding profile or interface.

## IP Passthrough

Netopia Firmware Version 5.4 offers an IP passthrough feature. The IP passthrough feature allows for a single PC on the LAN to have the router's public address assigned to it. It also provides PAT (NAPT) via the same public IP address for all other hosts on the private LAN subnet. Using IP passthrough:

- The public WAN IP is used to provide IP address translation for private LAN computers.
- The public WAN IP is assigned and reused on a LAN computer.
- DHCP address serving can automatically serve the WAN IP address to a LAN computer.

When DHCP is used for addressing the designated passthrough PC, the acquired or configured WAN address is passed to DHCP, which will dynamically configure a single-servable-address subnet, and reserve the address for the configured MAC address. This dynamic subnet configuration is based on the local and remote WAN address and subnet mask. If the WAN interface does not have a suitable subnet mask that is usable, for example when using PPP or PPPoE, the DHCP subnet configuration will default to a class C subnet mask.

Globally, only one dynamically-configured DHCP subnet is available. If you configure *multiple* Connection Profiles to use IP Passthrough's DHCP option, when any of these profiles is established, the dynamic DHCP configuration will be overwritten.

In the case of an Ethernet WAN router the IP passthrough configuration is located in the WAN Ethernet Configuration menu. For all other routers, it is located in the Connection Profiles' IP Profile Parameters.

The **WAN Ethernet Configuration** screen, found under the WAN Configuration menu, WAN Setup screen, appears as shown.

WAN Ethernet Configuration

Address Translation Enabled:	Yes
Local WAN IP Address:	0.0.0.0
NAT Map List...	Easy-PAT List
NAT Server List...	Easy-Servers
NAT Options...	
Stateful Inspection Enabled:	No
Filter Set...	
Remove Filter Set	
Enable PPP over Ethernet:	Off
WAN Ethernet Speed Setting...	Auto-Negotiation
Wan Ethernet MAC Address:	00:fc:de:fa:dd:02
DHCP Client Mode:	Standards-Based
RIP Options...	

Set up the basic IP attributes of your Ethernet Module in this screen.

The **IP Profile Parameters** screen, found under the WAN Configuration menu, Add/Change Connection Profile screen, appears as shown.

IP Profile Parameters

Address Translation Enabled:	Yes
IP Addressing...	Numbered
NAT Map List...	Easy-PAT List
NAT Server List...	Easy-Servers
NAT Options...	
Stateful Inspection Enabled:	No
Local WAN IP Address:	0.0.0.0
Local WAN IP Mask:	0.0.0.0
Filter Set...	
Remove Filter Set	
RIP Profile Options...	

Toggle to Yes if this is a single IP address ISP account.  
Configure IP requirements for a remote network connection here.

If you select **NAT Options**, in either case, the NAT Options screen appears.

NAT Options

IP Passthrough Enabled:	No
-------------------------	----

Toggle ON to allow local WAN IP address to be used on LAN in addition to NAT.

If you toggle **IP Passthrough Enabled** to **Yes**, additional field(s) appear.

NAT Options	
IP Passthrough Enabled:	Yes
IP Passthrough DHCP Enabled:	Yes
IP Passthrough DHCP MAC address:	00-00-00-00-00-00

Enter MAC addr. of IP passthrough host, or zeroes for first come first serve.

Toggling **IP Passthrough DHCP Enabled** to **Yes** displays the **IP Passthrough DHCP MAC address** field. This is an editable field in which you can enter the MAC (hardware) address of the designated PC be used as the DHCP Client Identifier for dynamic address reservation. The MAC address must be six colon-delimited or dash-delimited sets of hex digits ('0' – 'FF').

### ***First Come First Serve Mode***

Netopia Firmware Version 5.4 IP Passthrough allows a *first come first serve* mode.

NAT Options defaults to an all-zeroes MAC address.

If you leave the default all-zeroes MAC address, the Router will select the next DHCP client that initiates a DHCP lease request or renewal to be the IP passthrough host. When the WAN comes up, or if it is already up, the Router will serve this client the IP passthrough/WAN address. When this client's lease ends, the IP passthrough address becomes available for the next client to initiate a DHCP transaction. The next client will get the IP passthrough address. Note that there is no way to control which PC has the IP passthrough address without releasing all other DHCP leases on the LAN.

---

**Note:** If you specify a non-zeroes MAC address, the DHCP Client Identifier must be in the format specified above. Macintosh computers allow the DHCP Client Identifier to be entered as a name or text, however Netopia routers accept only strict (binary/hex) MAC address format. Macintosh computers display their strict MAC addresses in the TCP/IP Control Panel (Classic MacOS) or the Network Preference Pane of System Preferences (Mac OS X).

---

Once configured, the passthrough host's DHCP leases will be shortened to two minutes. This allows for timely updates of the host's IP address, which will be a private IP address *before* the WAN connection is established. *After* the WAN connection is established and has an address, the passthrough host can renew its DHCP address binding to acquire the WAN IP address.

### ***A restriction***

Since both the router and the passthrough host will use same IP address, new sessions that conflict with existing sessions will be rejected by the router. For example, suppose you are a teleworker using an IPSec tunnel from the router *and* from the passthrough host. Both tunnels go to the same remote endpoint, such as the VPN access concentrator at your employer's office. In this case, the first one to start the IPSec traffic will be allowed; the second one – since, from the WAN it's indistinguishable – will fail.

## MultiNAT Configuration Example

To help you understand a typical MultiNAT configuration, this section describes an example of the type of configuration you may want to implement on your site. The values shown are for example purposes only. *Make your own appropriate substitutions.*

A typical DSL service from an ISP might include five user addresses. Without PAT, you might be able to attach only five IP hosts. Using simple 1-to-many PAT you can connect more than five devices, but use only one of your addresses. Using multiNAT you can make full use of the address range. The example assumes the following range of addresses offered by a typical ISP:

Local WAN IP address:	206.1.1.6
Local WAN subnet mask:	255.255.255.248
Remote IP address:	206.1.1.254
Default gateway:	206.1.1.254

Public IP addresses assigned by the ISP are 206.1.1.1 through 206.1.1.6 (255.255.255.248 subnet mask).

Your internal devices have IP addresses of 192.168.1.1 through 192.168.1.254 (255.255.255.0 subnet mask).

Netopia Router's address is:	192.168.1.1
Web server's address is:	192.168.1.253
Mail server's address is:	192.168.1.254
FTP server's address is:	192.168.1.253

In this example you will statically map the first five public IP addresses (206.1.1.1 - 206.1.1.5) to the first five corresponding private IP addresses (192.168.1.1 - 192.168.1.5). You will use these 1-to-1 mapped addresses to give your servers "real" addresses. You will then map 206.1.1.6 to the remaining private IP addresses (192.168.1.6 - 192.168.1.254) using PAT.

The configuration process is as follows:

From the Main Menu go to the Easy Setup and then the Connection Profile screen.



Enter your ISP-supplied values as shown below.

```

                                Connection Profile 1: Easy Setup Profile

Connection Profile Name:          Easy Setup Profile

Address Translation Enabled:      Yes
IP Addressing...                  Numbered

Local WAN IP Address:            206.1.1.6
Local WAN IP Mask:              255.255.255.248

PREVIOUS SCREEN                  NEXT SCREEN

Enter a subnet mask in decimal and dot form (xxx.xxx.xxx.xxx).
Enter basic information about your WAN connection with this screen.
```

Select **NEXT SCREEN** and press Return.

Your IP values are shown here.

```

                                IP Easy Setup

Ethernet IP Address:             192.168.1.1
Ethernet Subnet Mask:           255.255.255.0

Domain Name:                    ISP.net
Primary Domain Name Server:     173.166.101.1
Secondary Domain Name Server:   173.166.102.1

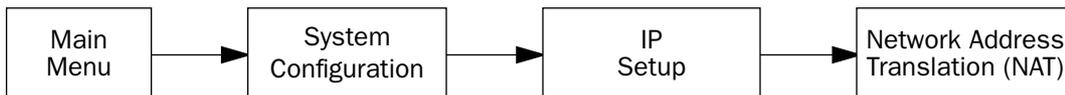
Default IP Gateway:             206.1.1.254
IP Address Serving:             On

Number of Client IP Addresses:  20
1st Client Address:             192.168.1.2

PREVIOUS SCREEN                  NEXT SCREEN

Set up the basic IP attributes of your Netopia in this screen.
```

Then navigate to the Network Address Translation (NAT) screen.



Select **Show/Change Public Range**, then **Easy-PAT Range**, and press Return. Enter the value your ISP assigned for your public address (206.1.1.6, in this example). Toggle **Type** to pat. Your public address is then mapped to the remaining private IP addresses using PAT. (If you were not using the Easy-PAT Range and Easy-PAT List that are created by default by using Easy Setup, you would have to *define* a public range and map list. For the purpose of this example you can just *alter* this range and list.)

```

Change NAT Public Range

Range Name:                Easy-PAT Range
Type...                    pat
Public Address:            206.1.1.6

First Public Port:        49152
Last Public Port:         65535

CHANGE NAT PUBLIC RANGE    CANCEL

```

Select **CHANGE NAT PUBLIC RANGE** and press Return. This returns you to the Network Address Translation screen.

Select **Add Public Range** and press Return. Type a name for this static range, as shown below. Enter the first and last public addresses your ISP assigned in their respective fields as shown. The first five public IP addresses (206.1.1.1 - 206.1.1.5, in this example) are statically mapped to the first five corresponding private IP addresses (192.168.1.1 - 192.168.1.5).

```

Add NAT Public Range

Range Name:                Static Range
Type...                    static
First Public Address:      206.1.1.1
Last Public Address:       206.1.1.5

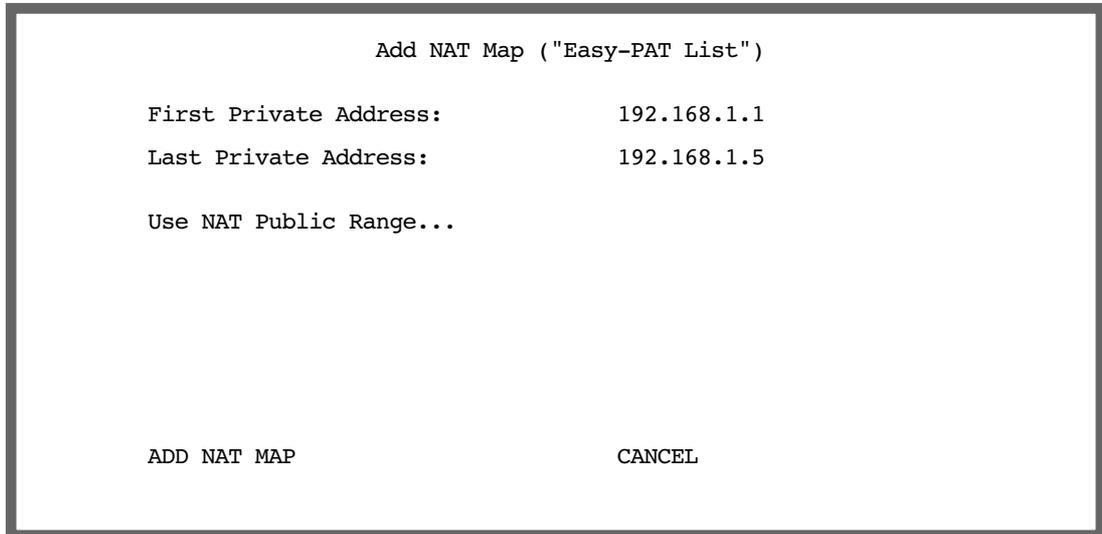
ADD NAT PUBLIC RANGE      CANCEL

Return/Enter to commit changes.

```

Select **ADD NAT PUBLIC RANGE** and press Return. You are returned to the Network Address Translation screen.

Next, select **Show/Change Map List** and choose **Easy-PAT List**. Select **Add Map**. The **Add NAT Map** screen appears. (Now the name *Easy-PAT List* is a misnomer since it has a static map included in its list.) Enter in 192.168.1.1 for the **First Private Address** and 192.168.1.5 for the **Last Private Address**.



The screenshot shows a terminal window titled "Add NAT Map ('Easy-PAT List')". It contains the following text:

```

Add NAT Map ("Easy-PAT List")

First Private Address:      192.168.1.1
Last Private Address:      192.168.1.5

Use NAT Public Range...

ADD NAT MAP                CANCEL
```

Select **Use NAT Public Range** and from the pop-up menu choose **Static Range**. Select **ADD NAT MAP** and press Return.

This will statically map the first five public IP addresses to the first five corresponding private IP addresses and will map 206.1.1.6 to the remaining private IP addresses using PAT.

### **Notes on the example**

The Easy-Map List and the Easy-PAT List are attached to any new Connection Profile by default. If you want to use this NAT configuration on a previously defined Connection Profile then you need to *bind* the Map List to the profile. You do this through either the NAT Associations screen or the profile's configuration screens.

The PAT part of this example setup will allow any user on the Netopia Router's LAN with an IP address in the range of 192.168.1.6 through 192.168.1.254 to *initiate* traffic flow to the outside world (for example, the Internet). No one on the Internet would be able to initiate a conversation with them.

The Static mapping part of this example will allow any of the machines in the range of addresses from 192.168.1.1 through 192.168.1.5 to communicate with the outside world as if they were at the addresses 206.1.1.1 through 206.1.1.5, respectively. It also allows any machine on the Internet to access any service (port) on any of these five machines.

You may decide this poses a security risk. You may decide that anyone can have complete access to your FTP server, but not to your router, and only limited access to the desired services (ports) on the Web and Mail servers.

To make these changes, first limit the range of remapped addresses on the Static Map and then edit the default server list called Easy-Servers.

- First, navigate to the **Show/Change Map List** screen, select **Easy-PAT List** and then **Show/Change Maps**. Choose the **Static Map** you created and change the **First Private Address** from 192.168.1.1 to 192.168.1.4. Now the router, Web, and Mail servers' IP addresses are no longer included in the range of static mappings and are therefore no longer accessible to the outside world. Users on the Internet will not be able to Telnet, Web, SNMP, or ping to them. It is best also to navigate to the public range screen and change the **Static Range** to go from 206.1.1.5.
- Next, navigate to **Show/Change Server List** and select **Easy-Servers** and then **Add Server**. You should export both the Web (www-http) and Mail (smtp) ports to one of the now free public addresses. Select **Service...** and from the resulting pop-up menu select **www-http**. In the resulting screen enter your Web server's address, 192.168.1.2, and the public address, for example, 206.1.1.2, and then select **ADD NAT SERVER**. Now return to **Add Server**, choose the **smtp** port and enter 192.168.1.3, your Mail server's IP address for the **Server Private IP Address**. You can decide if you want to present both your Web and Mail services as being on the same public address, 206.1.1.2, or if you prefer to have your Mail server appear to be at a different IP address, 206.1.1.3. For the sake of this example, alias both services to 206.1.1.2.

Now, as before, the PAT configuration will allow any user on the Netopia Router's LAN with an IP address in the range of 192.168.1.6 through 192.168.1.254 to initiate traffic flow to the Internet. Someone at the FTP server can access the Internet and the Internet can access all services of the FTP machine as if it were at 206.1.1.5. The router cannot directly communicate with the outside world. The only communication between the Web server and the Internet is through port 80, the Web port, as if the server were located on a machine at IP address 206.1.1.2. Similarly, the only communication with the Mail server is through port 25, the SMTP port, as if it were located at IP address 206.1.1.2.



## Chapter 4

# Virtual Private Networks (VPNs)

The Netopia Firmware Version 5.4 offers IPsec, PPTP, and ATMP tunneling support for Virtual Private Networks (VPN).

The following topics are covered in this chapter:

- "Overview" on page 4-1
- "About PPTP Tunnels" on page 4-4
- "About IPsec Tunnels" on page 4-7
- "About ATMP Tunnels" on page 4-8
- "Encryption Support" on page 4-10
- "ATMP/PPTP Default Profile" on page 4-11
- "VPN QuickView" on page 4-13
- "Dial-Up Networking for VPN" on page 4-14
- "Installing the VPN Client" on page 4-17
- "Allowing VPNs through a Firewall" on page 4-19
- "Windows Networking Broadcasts" on page 4-25

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## Overview

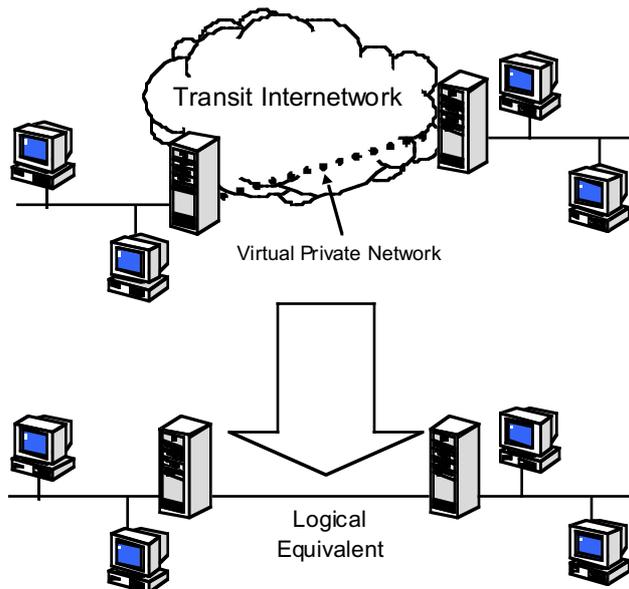
When you make a long distance telephone call from your home to a relative far away, you are creating a private network. You can hold a conversation, and exchange information about the happenings on opposite sides of the state, or the continent, that you are mutually interested in. When your next door neighbor picks up the phone to call her daughter at college, at the same time you are talking to your relatives, your calls don't overlap, but each is separate and private. Neither house has a direct wire to the places they call. Both share the same lines on the telephone poles (or underground) on the street.

These calls are *virtual private networks*. *Virtual*, because they appear to be direct connections between the calling and answering parties, even though they travel over the public wires and switches of the phone company; *private*, because neither pair of calling and answering parties interacts with the other; and *networks*, because they exchange information.

Computers can do the same thing; it's called Virtual Private Networks (VPNs). Equipped with a Router, a single computer or private network (LAN) can establish a private connection with another computer or private network over the public network (Internet).

The Netopia Firmware Version 5.4 can be used in VPNs either to initiate the connection or to answer it. When used in this way, the routers are said to be *tunnelling* through the public network (Internet). The advantages are that, like your long distance phone call, you don't need a direct line between one computer or LAN and the other, but use the local connections, making it much cheaper; and the information you exchange through your tunnel is private and secure.

Tunneling is a process of creating a private path between a remote user or private network and another private network over some intermediate network, such as the IP-based Internet. A VPN allows remote offices or employees access to your internal business LAN through means of encryption allowing the use of the public Internet to look “virtually” like a private secure network. When two networks communicate with each other through a network based on the Internet Protocol, they are said to be *tunneling* through the IP network.



Unlike the phone company, private and public computer networks can use more than one protocol to carry your information over the wires. Three such protocols are in common use for tunnelling, Point-to-Point Tunneling Protocol (PPTP), Ascend Tunnel Management Protocol (ATMP), and IP Security (IPsec). The Netopia Router can use any one.

- Point-to-Point Tunneling Protocol (PPTP) is an extension of Point-to-Point Protocol (PPP) and uses a client and server model. Netopia's PPTP implementation is compatible with Microsoft's and can function as either the client (PAC) or the server (PNS). As a client, a Netopia R-series router can provide all users on a LAN with secure access over the Internet to the resources of another LAN by setting up a tunnel with a Windows NT server running Remote Access Services (RAS) or with another Netopia Router. As a server, a Netopia R-series router can provide remote users a secure connection to the resources of the LAN over a dial-up, cable, DSL, or any other type of Internet access. Because PPTP can create a VPN tunnel using the Dial-Up Networking (DUN) (see "[Dial-Up Networking for VPN](#)" on page 4-14) utility built into Windows 95, 98, or NT, no additional client software is required.
- Ascend Tunnel Management Protocol (ATMP) is the protocol that is implemented in many Ascend routers. ATMP is a simple protocol for connecting nodes and/or networks together over the Internet via a tunnel. ATMP encapsulates IP or other user data without PPP headers within General Routing Encapsulation (GRE)

protocol over IP. ATMP is more efficient than PPTP for network-to-network tunnels.

- *IPsec* stands for IP Security, a set of protocols that supports secure exchange of IP packets at the IP layer. IPsec is deployed widely to implement Virtual Private Networks (VPNs). IPsec supports two encryption modes: Transport and Tunnel. Transport mode encrypts only the data portion (payload) of each packet, but leaves the header untouched. The more secure Tunnel mode encrypts both the header and the payload. On the receiving side, an IPsec-compliant device decrypts each packet. The Netopia Firmware Version 5.4 supports the more secure Tunnel mode.

*DES* stands for Data Encryption Standard, a popular symmetric-key encryption method. DES uses a 56-bit key. The Netopia Firmware Version 5.4 offers IPsec DES encryption over the VPN tunnel.

When used to initiate the tunnelled connection, the Router is called a *PPTP Access Concentrator (PAC, in PPTP language)*, or a *foreign agent* (in ATMP language). When used to answer the tunnelled connection, the Netopia Router is called a *PPTP Network Server (PNS, in PPTP language)* or a *home agent* (in ATMP language).

In either case, the Netopia Router wraps, or encapsulates, information that one end of the tunnel exchanges with the other, in a wrapper called General Routing Encapsulation (GRE), at one end of the tunnel, and unwraps, or decapsulates, it at the other end.

Configuring the Netopia Router for use with the different protocols is done through the console-based menu screens. Each type is described in its own section:

- ["About PPTP Tunnels" on page 4-4](#)
- ["About IPsec Tunnels" on page 4-7](#)
- ["About ATMP Tunnels" on page 4-8](#)

Your configuration depends on which protocol you (and the router at the other end of your tunnel) will use, and whether or not you will be using the VPN client software in a standalone remote connection.

---

**Note:** You must choose which protocol you will be using, since you cannot both export PPTP and use ATMP, or vice versa, at the same time.

---

Having both an ATMP tunnel and a PPTP export is not possible because functions require GRE and the router's PPTP export/server does not distinguish the GRE packets it forwards. Since it processes all of them, ATMP tunneling is impaired. For example, you cannot run an ATMP tunnel between two routers and also have PPTP exported on one side.

## Summary

A Virtual Private Network (VPN) connects the components of one network over another network. VPNs accomplish this by allowing you to *tunnel* through the Internet or another public network in a manner that provides the same security and features formerly available only in private networks.

VPNs allow networks to communicate across an IP network. Your local networks (connected to the Netopia Router) can exchange data with remote networks that are also connected to a VPN-capable router.

This feature provides individuals at home, on the road, or in branch offices with a cost-effective and secure way to access resources on remote LANs connected to the Internet with Netopia Routers. The feature is built around three key technologies: PPTP, IPsec, and ATMP.

## About PPTP Tunnels

To set up a PPTP tunnel, you create a Connection Profile including the IP address and other relevant information for the remote PPTP partner. You use the same procedure to initiate a PPTP tunnel that terminates at a remote PPTP server or to terminate a tunnel initiated by a remote PPTP client.

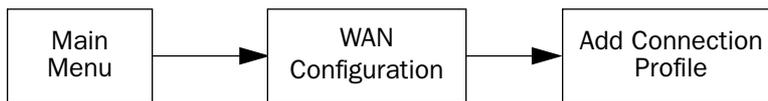
### PPTP configuration

To set up the router as a PPTP Network Server (PNS) capable of answering PPTP tunnel requests you must also configure the VPN Default Answer Profile. See ["ATMP/PPTP Default Profile"](#) on page 4-11 for more information.

PPTP is a Datalink Encapsulation option in Connection Profiles. It is not an option in device or link configuration screens, as PPTP is not a native encapsulation. Consequently, the Easy Setup Profile does not offer PPTP datalink encapsulation. See the ["Creating a New Connection Profile"](#) on page 2-24 for information on creating Connection Profiles.

Channel 4 (and higher) events, such as connections and disconnections, reported in the WAN Event Histories are VPN tunnel events.

To define a PPTP tunnel, navigate to the Add Connection Profile menu from the Main Menu.



Add Connection Profile

Profile Name:	Profile 1
Profile Enabled:	+
Data Link Encapsulation...	+ PPP Frame Relay RFC1483 ATMP PPTP IPsec +
IP Profile Parameters...	+
COMMIT	CANCEL

When you define a Connection Profile as using PPTP by selecting PPTP as the datalink encapsulation method, and then select **Data Link Options**, the PPTP Tunnel Options screen appears.

PPTP Tunnel Options	
PPTP Partner IP Address:	173.167.8.134
Tunnel Via Gateway:	0.0.0.0
Authentication...	CHAP
Data Compression...	None
Send Host name:	tony
Send Password:	*****
Receive Host name:	kimba
Receive Password:	*****
Initiate Connections:	Yes
On Demand:	Yes
Optional Windows NT Domain Name:	
Idle Timeout (seconds):	300

- Enter the **PPTP Partner IP Address**. This specifies the address of the other end of the tunnel.  
If you do not specify the PPTP Partner IP Address the gateway cannot initiate tunnels, i.e., act as a PPTP Access Concentrator (PAC) for this profile. It can only accept tunnel requests as a PPTP Network Server (PNS).
- If you specify the PPTP Partner IP Address, and the address is in the same subnet as the Remote IP Address you specified in the IP Profile Parameters, the **Tunnel Via Gateway** option becomes visible. You can enter the address by which the gateway partner is reached.  
If you do not specify the PPTP Partner IP Address, the router will use the default gateway to reach the partner and the **Tunnel Via Gateway** field is hidden. If the partner should be reached via an alternate port (i.e. the LAN instead of the WAN), the **Tunnel Via Gateway** field allows this path to be resolved.
- From the pop-up menu select an **Authentication** protocol for the PPP connection. Options are PAP, CHAP, or MS-CHAP. The default is PAP. The authentication protocol must be the same on both ends of the tunnel.
- You can specify a **Data Compression** algorithm, either None or Standard LZS, for the PPTP connection.  
**Note:** When the Authentication protocol is MS-CHAP, compression is set to None, and the **Data Compression** option is hidden.
- When the authentication protocol is MS-CHAP, you can specify a **Data Encryption** algorithm for the PPTP connection. Available options are MPPE and None (the default). For other authentication protocols, this option is hidden. When MPPE is negotiated, the WAN Event History reports that it is negotiated as a CCP (compression) type. This is because the MPPE protocol uses a compression engine, even though it is not itself a compression protocol.

---

**Note:** The Netopia Firmware Version 5.4 supports 128-bit (“strong”) encryption. Unlike MS-CHAP version 1, which supports one-way authentication, MS-CHAP version 2 supports mutual authentication between connected routers and is incompatible with MS-CHAP version 1 (MS-CHAP-V1). When you choose MS-CHAP as the authentication method for the PPTP tunnel, the Netopia router will start negotiating MS-CHAP-V2. If the router you are connecting to does not support MS-CHAP-V2, it will fall back to MS-CHAP-V1, or, if the router you are connecting to does not support MPPE at all, the PPP session will be dropped.

---

- You can specify a **Send Host Name** which is used with Send Secret for authenticating with a remote PNS when the profile is used for initiating a tunnel connection.
- You must specify a **Send Password** (the CHAP and MS-CHAP term for password), used for authenticating the tunnel when initiating a tunnel connection.
- You can specify a **Receive Host Name** which is used with the Receive Secret for authenticating a remote PPTP client.
- You must specify a **Receive Password**, used for authenticating the remote PPTP client.
- You can specify that this router will **Initiate Connections** (acting as a PAC) or only answer them (acting as a PNS).
- Tunnels are normally initiated **On Demand**; however, you can disable this feature. When disabled, the tunnel must be manually established or may be scheduled using the scheduled connections feature. See ["Scheduled Connections" on page 2-29](#).
- Some networks that use Microsoft Windows NT PPTP Network Servers require additional authentication information, called *Windows NT Domain Name*, when answering PPTP tunnel connection requests. Not all Windows NT installations require this information, since not all such installations use this authentication feature. The Windows NT Domain Name is not the same as the Internet domain name, but is the name of a group of servers that share common security policy and user account databases. Your PPTP tunnel partner’s administrator will supply this Windows NT Domain Name if it is required. If you configure your Router to initiate PPTP tunnel connections by toggling **Initiate Connections** to **Yes**, the **Optional Windows NT Domain Name** field appears. Enter the domain name your network administrator has supplied.
- You can specify the **Idle Timeout**, an inactivity timer, whose expiration will terminate the tunnel. A value of zero disables the timer. Because tunnels are subject to abrupt termination when the underlying datalink is torn down, use of the Idle Timeout is strongly encouraged.
- Return to the Connection Profile screen by pressing Escape.
- Select **IP Profile Parameters** and press Return.

The IP Profile Parameters screen appears.

IP Profile Parameters

Address Translation Enabled:	Yes
NAT Map List...	Easy-PAT
NAT Server List...	Easy-Servers
Local WAN IP Address:	0.0.0.0
Remote IP Address:	173.167.8.10
Remote IP Mask:	255.255.0.0
Filter Set...	
Remove Filter Set	
RIP Profile Options...	

- Enter the **Remote IP Address** and **Remote IP Mask** for the host to which you want to tunnel.

---

## About IPsec Tunnels

*IPsec* stands for IP Security, a set of protocols that supports secure exchange of IP packets at the IP layer. IPsec is deployed widely to implement Virtual Private Networks (VPNs). See "[Overview](#)" on [page 4-1](#) for more information.

IPsec supports two encryption modes: Transport and Tunnel. Transport mode encrypts only the data portion (payload) of each packet, but leaves the header untouched. The more secure Tunnel mode encrypts both the header and the payload. On the receiving side, an IPsec-compliant device decrypts each packet. Netopia Routers support the more secure Tunnel mode.

Netopia Firmware Version 5.4 offers IPsec 3DES encryption over the VPN tunnel. *DES* stands for Data Encryption Standard, a popular symmetric-key encryption method. DES uses a 56-bit key. Netopia Routers offer IPsec 3DES (triple DES) encryption as a standard option. Some models support built-in hardware acceleration of 3DES encryption at line speeds.

*Internet Key Exchange (IKE)* is an authentication and encryption key management protocol used in conjunction with the IPsec standard. IPsec key management offers a wide variety of options which are explained in [Chapter 5, "Internet Key Exchange \(IKE\) IPsec Key Management for VPNs."](#)

## About ATMP Tunnels

To set up an ATMP tunnel, you create a Connection Profile including the IP address and other relevant information for the remote ATMP partner. ATMP uses the terminology of a *foreign agent* that initiates tunnels and a *home agent* that terminates them. You use the same procedure to initiate or terminate an ATMP tunnel. Used in this way, the terms *initiate* and *terminate* mean the beginning and end of the tunnel; they do not mean *activate* and *deactivate*.

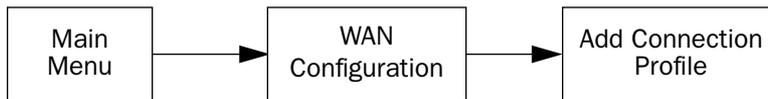
ATMP is a tunneling protocol, with two basic aspects. Tunnels are created and torn down using a session protocol that is UDP-based. User (or client) data is transferred across the tunnel by encapsulating the client data within Generic Routing Encapsulation (GRE). The GRE data is then routed using standard methods.

## ATMP configuration

ATMP is a Datalink Encapsulation option in Connection Profiles. It is not an option in device or link configuration screens, since ATMP is not a native encapsulation. The Easy Setup Profile does not offer ATMP datalink encapsulation. See "[Creating a New Connection Profile](#)" on page 2-24 for information on creating Connection Profiles.

The WAN Event History screens will report VPN tunnel events, such as connections and disconnections, as Channel 4 (and higher) events.

To define an ATMP tunnel, navigate to the **Add Connection Profile** menu from the Main Menu.



Add Connection Profile

Profile Name:	Profile 2
Profile Enabled:	+
Data Link Encapsulation...	PPP
Data Link Options...	Frame Relay
	RFC1483
	ATMP
	PPTP
	IPsec
	+
IP Profile Parameters...	

COMMIT
CANCEL

When you define a Connection Profile as using ATMP by selecting ATMP as the datalink encapsulation method, and then select **Data Link Options**, the ATMP Tunnel Options screen appears.

ATMP Tunnel Options	
ATMP Partner IP Address:	173.167.8.134
Tunnel Via Gateway:	0.0.0.0
Network Name:	sam.net
Password:	****
Data Encryption...	DES
Key String:	
Initiate Connections:	Yes
On Demand:	Yes
Idle Timeout (seconds):	300

**Note:** An ATMP tunnel cannot be assigned a dynamic IP address by the remote server, as in a PPP connection. When you define an ATMP tunnel profile, the Local WAN IP Address, assigned in the IP Profile Parameters screen, must be the true IP address, not 0.0.0.0, if NAT is enabled.

- **ATMP Partner IP Address** specifies the address of the other end of the tunnel. When unspecified, the gateway can not initiate tunnels (i.e., act as a foreign agent) for this profile; it can only accept tunnel requests as a home agent.
- When you specify the ATMP Partner IP Address, and the address is in the same subnet as the Remote IP Address you specified in the IP Profile Parameters, you can specify the route (**Tunnel Via Gateway**) by which the gateway partner is reached. If you do not specify the ATMP Partner IP Address, the router will use the default gateway to reach the partner and the **Tunnel Via Gateway** field is hidden. If the partner should be reached via an alternate port (i.e., the LAN instead of the WAN), the **Tunnel Via Gateway** field allows this path to be resolved.
- You can specify a **Network Name**. When the tunnel partner is another Netopia router, this name may be used to match against a Connection Profile. When the partner is an Ascend router in Gateway mode, then **Network Name** is used by the Ascend router to match a gateway profile. When the partner is an Ascend router in Router mode, leave this field blank.
- You must specify a **Password**, used for authenticating the tunnel.
 

**Note:** The Password entry will be the same for both ends of the tunnel.
- For Netopia-to-Netopia connections only, you can specify a **Data Encryption** algorithm for the ATMP connection from the pop-up menu, either DES or None. None is the default.
 

**Note:** Ascend does not support DES encryption for ATMP tunnels.
- You must specify a **Key String** of up to (and including) 20 characters when DES is selected. When encryption is None, this field is invisible.
- You can specify that this router will **Initiate Connections**, acting as a foreign agent (**Yes**), or only answer

them, acting as a home agent (**No**).

- Tunnels are normally initiated **On Demand**; however, you can disable this feature. When disabled, the tunnel must be manually established through the call management screens.
- You can specify the **Idle Timeout**, an inactivity timer, whose expiration will terminate the tunnel. A value of zero disables the timer. Because tunnels are subject to abrupt termination when the underlying datalink is torn down, use of the Idle Timeout is strongly encouraged.
- Return to the Connection Profile screen by pressing Escape.
- Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

IP Profile Parameters

Address Translation Enabled:	Yes
NAT Map List...	Easy-PAT
NAT Server List...	Easy-Servers
Local WAN IP Address:	0.0.0.0
Remote IP Address:	173.167.8.10
Remote IP Mask:	255.255.0.0
Filter Set...	
Remove Filter Set	
RIP Profile Options...	

- Enter the **Remote IP Address** and **Remote IP Mask** for the host to which you want to tunnel.

---

## Encryption Support

Encryption is a method for altering user data into a form that is unusable by anyone other than the intended recipient. The recipient must have the means to decrypt the data to render it usable to them. The encryption process protects the data by making it difficult for any third party to get at the original data.

Netopia PPTP is fully compatible with Microsoft Point-to-Point Encryption (MPPE) data encryption for user data transfer over the PPTP tunnel. Microsoft Windows NT Server provides MPPE encryption capability only when Microsoft Challenge Handshake Authentication Protocol (MS-CHAP) is enabled. Netopia complies with this feature to allow MPPE only when MS-CHAP is negotiated. MS-CHAP and MPPE are user-selectable options in the PPTP Tunnel Options screen. If either the client or the server side specifies encryption, then encryption becomes mandatory for both.

Netopia's ATMP implementation supports Data Encryption Standard (DES) data encryption for user data transfer over the ATMP tunnel between two Netopia routers. The encryption option, none or DES, is a selectable option in the ATMP Tunnel Options screen.

## MS-CHAP V2 and 128-bit strong encryption

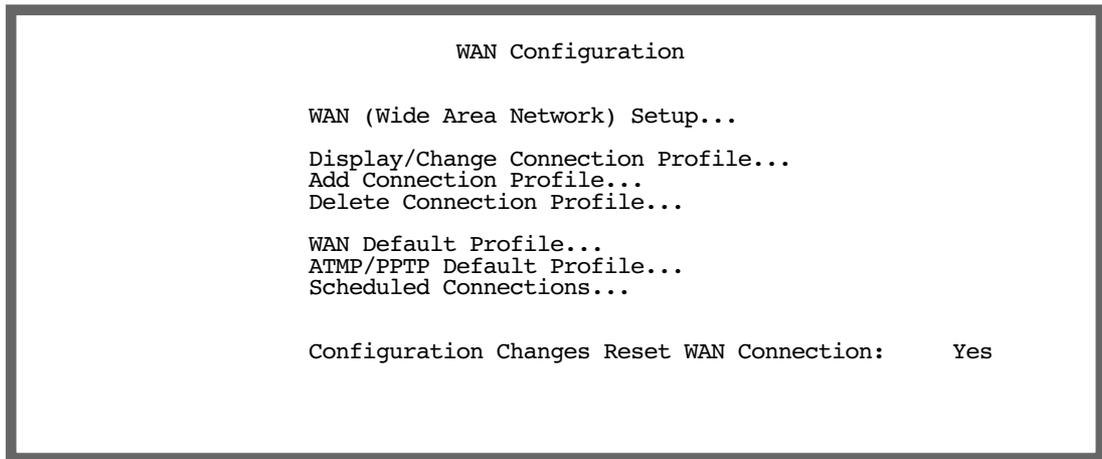
### Notes:

- The Netopia Firmware Version 5.4 supports 128-bit (“strong”) encryption when using PPTP tunnels. ATMP does not have an option of using 128-bit MPPE. If you are using ATMP between two Netopia routers you can optionally set 56-bit DES encryption.
- When you choose MS-CHAP as the authentication method for a PPTP tunnel, the Netopia router will start negotiating MS-CHAPv2. If the router or VPN adapter client you are connecting to does not support MS-CHAPv2, the Netopia router will fall back to MS-CHAPv1, or, if the router or VPN adapter client you are connecting to does not support MPPE at all, the PPP session will be dropped. This is done automatically and transparently.

---

## ATMP/PPTP Default Profile

The WAN Configuration menu offers a ATMP/PPTP Default Profile option. Use this selection when your router is acting as the server for VPN connections, that is, when you are on the answering end of the tunnel establishment. The ATMP/PPTP Default Profile determines the way the attempted tunnel connection is answered.



To set the parameters under which the router will answer attempted VPN connections, select **ATMP/PPTP Default Profile** and press Return. The ATMP/PPTP Default Profile screen appears.

```
ATMP/PPTP Default Profile

Answer ATMP/PPTP Connections:      No
PPTP Configuration Options
Receive Authentication...           PAP
Data Compression...                 None
```

- Toggle **Answer ATMP/PPTP Connections** to **Yes** if you want the router to accept VPN connections or **No** (the default) if you do not.
  - For PPTP tunnel connections only, you must define what type of authentication these connections will use. Select **Receive Authentication** and press Return. A pop-up menu offers the following options: PAP (the default), CHAP, or MS-CHAP.
  - If you chose PAP or CHAP authentication, from the **Data Compression** pop-up menu select either None (the default) or Standard LZS.
- If you chose MS-CHAP authentication, the **Data Compression** option is not required, and this menu item becomes hidden.

## VPN QuickView

You can view the status of your VPN connections in the VPN QuickView screen.

From the Main Menu select QuickView and then VPN QuickView.



The VPN QuickView screen appears.

VPN Quick View						
Profile Name-----	Type-----	Rx Pckts---	Tx Pckts--	RxDiscard--	Remote Address--	
HA <-> FA1 (Jony Fon	ATMP	99	99	0	173.166.82.8	
HA <-> FA3 (Sleve M.	ATMP	13	14	0	173.166.117.91	

**Profile Name:** Lists the name of the Connection Profile being used, if any.

**Type:** Shows the data link encapsulation method (PPTP or ATMP).

**Rx Pckts:** Shows the number of packets received via the VPN tunnel.

**Tx Pckts:** Shows the number of packets transmitted via the VPN tunnel.

**Rx Discard:** Shows the number of packets discarded.

**Remote Address:** Shows the tunnel partner's IP address.

---

## *Dial-Up Networking for VPN*

Microsoft Windows Dial-Up Networking software permits a remote standalone workstation to establish a VPN tunnel to a PPTP server such as a Netopia Router located at a central site. Dial-Up Networking also allows a mobile user who may not be connected to a PAC to dial into an intermediate ISP and establish a VPN tunnel to, for example, a corporate headquarters, remotely. Netopia Routers also can serve as a PAC at the workstation's site, making it unnecessary for the standalone workstation to initiate the tunnel. In such a case, the Dial-Up Networking software is not required, since the Netopia Router initiates the tunnel.

This section is provided for users who may require the VPN client software for Dial-Up Networking in order to connect to an ISP who provides a PPTP account.

Microsoft Windows Dial-Up Networking (DUN) is the means by which you can initiate a VPN tunnel between your individual remote client workstation and a private network such as your corporate LAN via the Internet. DUN is a software adapter that allows you to establish a tunnel.

DUN is a free add-on available for Windows 95, and comes standard with Windows 98 and Windows NT. The VPN tunnel behaves as a private network connection, unrelated to other traffic on the network. Once you have installed Dial-Up Networking, you will be able to connect to your remote site as if you had a direct private connection, regardless of the intervening network(s) through which your data passes. You may need to install the Dial-Up Networking feature of Windows 95, 98, or 2000 to take advantage of the virtual private networking feature of your Netopia router.

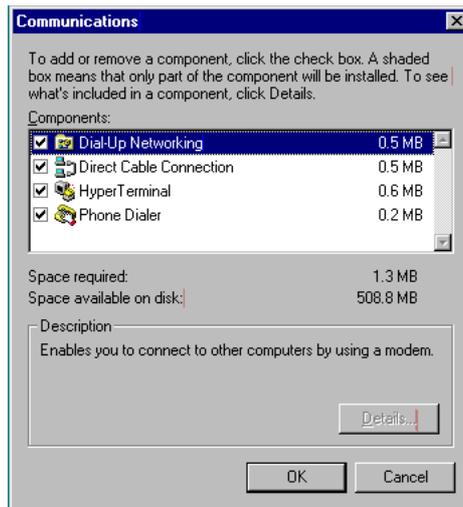
**Note:** For the latest information and tech notes on Dial-Up Networking and VPNs be sure to visit the Netopia website at <http://www.netopia.com> and, for the latest software and release notes, the Microsoft website at <http://www.microsoft.com>.

### **Installing Dial-Up Networking**

Check to see if Dial-Up Networking is already installed on your PC. Open your My Computer (or whatever you have named it) icon on your desktop. If there is a folder named Dial-Up Networking, you don't have to install it. If there is no such folder, you must install it from your system disks or CDROM. Do the following:

1. From the **Start** menu, select **Settings** and then **Control Panel**.
2. In the Control Panel window, double-click the **Add/Remove Programs** icon.  
The Add/Remove Programs Properties window appears.
3. Click the **Windows Setup** tab.
4. Double-click **Communications**.

The Communications window appears.



5. In the Communications window, select **Dial-Up Networking** and click the **OK** button.  
This returns you to the Windows Setup screen. Click the **OK** button.
6. Respond to the prompts to install Dial-Up Networking from the system disks or CDROM.
7. When prompted, reboot your PC.

## Creating a new Dial-Up Networking profile

A Dial-Up Networking profile is like an address book entry that contains the information and parameters you need for a secure private connection. You can create this profile by using either the Internet Connection Wizard or the Make New Connection feature of Dial-Up Networking. The following instructions tell you how to create the profile with the Make New Connection feature. Do the following:

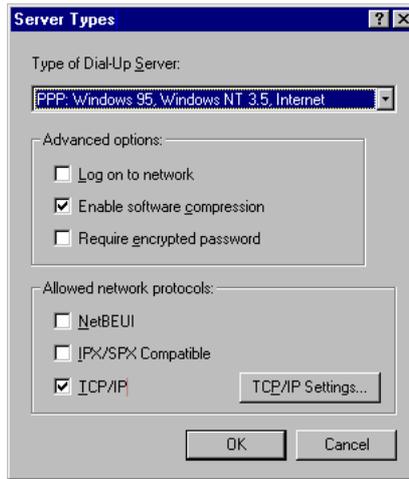
1. Double-click the **My Computer** (or whatever you have named it) icon on your desktop.  
Open the Dial-Up Networking folder, and then double-click **Make New Connection**. The Make New Connection wizard window appears.
2. Type a name for this connection (such as the name of your company, or the computer you are dialing into).  
From the pull-down menu, select the device you intend to use for the virtual private network connection. This can be any device you have installed or connected to your PC. Click the **Next** button. A screen appears with fields for you to enter telephone numbers for the computer you want to connect to.
3. Type the directory number or the **Virtual Circuit Identifier** number.  
This number is provided by your ISP or corporate administrator. Depending on the type of device you are using, the number may or may not resemble an ordinary telephone directory number.
4. Click the **Next** button.  
The final window will give you a chance to accept or change the name you have entered for this profile. If you are satisfied with it, click the **Finish** button. Your profile is complete.

## Configuring a Dial-Up Networking profile

Once you have created your Dial-Up Networking profile, you configure it for TCP/IP networking to allow you to connect to the Internet through your Internet connection device. Do the following:

1. Double-click the **My Computer** (or whatever you have named it) icon on your desktop.  
Open the Dial-Up Networking folder. You will see the icon for the profile you created in the previous section.
2. Right-click the icon and from the pop-up menu select **Properties**.
3. In the Properties window click the **Server Type** button.

From the Type of Dial-up Server pull-down menu select the appropriate type of server for your system version:

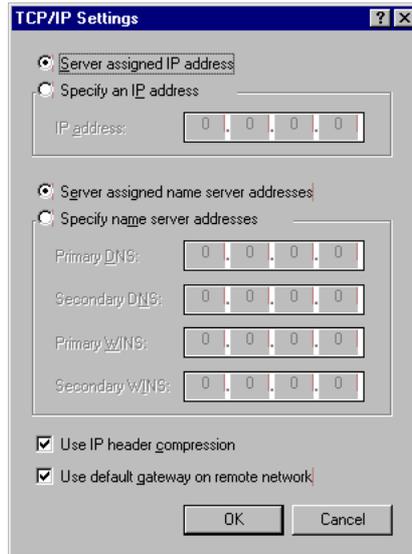


- Windows 95 users select **PPP: Windows 95, Windows NT 3.5, Internet**
- Windows 98 users select **PPP: Windows 98, Windows NT Server, Internet**

In the Allowed network protocols area check **TCP/IP** and uncheck all of the other checkboxes.

**Note:** Netopia's PPTP implementation does not currently support tunnelling of IPX and NetBEUI protocols.

- Click the **TCP/IP Settings** button.



- If your ISP uses dynamic IP addressing (DHCP), select the Server assigned IP address radio button.
  - If your ISP uses static IP addressing, select the Specify an IP address radio button and enter your assigned IP address in the fields provided. Also enter the IP address in the Primary and Secondary DNS fields.
- Click the **OK** button in this window and the next two windows.

---

## Installing the VPN Client

Before Installing the VPN Client you must have TCP/IP installed and have an established Internet connection.

### Windows 95 VPN installation

- From your Internet browser navigate to the following URL:  
<http://www.microsoft.com/NTServer/nts/downloads/recommended/dun13win95/releasenotes.aso>  
 Download the Microsoft Windows 95 VPN patch dun 1.3 to the Windows 95 computer you intend to use as a VPN client with PPTP. Follow the installation instructions.
- From the Windows 95 **Start** menu select **Settings**, then **Control Panel** and click once.  
 The Control Panel screen appears.
- Double-click **Add/Remove Programs**.  
 The Add/Remove Programs screen appears.
- Click the **Windows Setup** tab.  
 The Windows Setup screen will be displayed within the top center box.
- Highlight **Communications** and double-click.

This displays a list of possible selections for the communications option. Active components will have a check in the checkboxes to their left.

6. Check **Dial Up Networking** at the top of the list and **Virtual Private Networking** at the bottom of the list.
7. Click **OK** at the bottom right on each screen until you return to the Control Panel. Close the Control Panel by clicking the upper right corner X.
8. Double-click the **My Computer** icon (normally at the left upper corner of the screen).

This will display the devices within My Computer. Scroll down the list to **Dial-Up Networking** and double-click it.

9. Double click **Make New Connection**.

This displays the Make New Connection installation screen. In this screen you will see a box labelled **Select a device**. From the pull-down menu to the right, select **Microsoft VPN Adapter**.

Click the **Next** button at the bottom of the screen

This displays the **VPN Host** screen. In the box to the top center of the screen enter your VPN server's IP address (for example, 192.168.xxx.xxx. This is not a proper Internet address)

## Windows 98 VPN installation

1. From the Windows 98 **Start** menu select **Settings**, then **Control Panel** and click once.

The Control Panel screen appears.

2. Double-click **Add/Remove Programs**.

The Add/Remove Programs screen appears.

3. Click the **Windows Setup** tab.

The Windows Setup screen will be displayed within the top center box.

4. Double-click **Communications**.

This displays a list of possible selections for the communications option. Active components will have a check in the checkboxes to their left.

5. Check **Dial Up Networking** at the top of the list and **Virtual Private Networking** at the bottom of the list.
6. Click **OK** at the bottom right on each screen until you return to the Control Panel. Close the Control Panel by clicking the upper right corner X.
7. Double-click the **My Computer** icon (normally at the left upper corner of the screen).

This will display the devices within My Computer. Scroll down the list to **Dial-Up Networking** and double-click it.

8. Double click **Make New Connection**.

This displays the Make New Connection installation screen. In this screen you will see a box labelled **Select a device**. From the pull-down menu to the right, select **Microsoft VPN Adapter**.

Click the **Next** button at the bottom of the screen

This displays the **VPN Host** screen. In the box to the top center of the screen enter your VPN server's IP address (for example, 192.168.xxx.xxx. This is not a proper Internet address)

## Connecting using Dial-Up Networking

A Dial-Up Networking connection will be automatically launched whenever you run a TCP/IP application, such as a web browser or email client. When you first run the application a Connect To dialog box appears in which you enter your User name and Password. If you check the Save password checkbox, the system will remember your User name and Password, and you won't be prompted for them again.

---

## *Allowing VPNs through a Firewall*

An administrator interested in securing a network will usually combine the use of VPNs with the use of a firewall or some similar mechanism. This is because a VPN is not a complete security solution, but rather a component of overall security. Using a VPN will add security to transactions carried over a public network, but a VPN alone will not prevent a public network from infiltrating a private network. Therefore, you should combine use of a firewall with VPNs, where the firewall will secure the private network from infiltration from a public network, and the VPN will secure the transactions that must cross the public network.

A strict firewall may not be provisioned to allow VPN traffic to pass back and forth as needed. In order to ensure that a firewall will allow a VPN, certain attributes must be added to the firewall's provisioning. The provisions necessary vary slightly between ATMP and PPTP, but both protocols operate on the same basic premise: there are control and negotiation operations, and there is the tunnelled traffic that carries the payload of data between the VPN endpoints. The difference is that ATMP uses UDP to handle control and negotiation, while PPTP uses TCP. Then both ATMP and PPTP use GRE to carry the payload.

For PPTP negotiation to work, TCP packets inbound and outbound destined for port 1723 must be allowed. Likewise, for ATMP negotiation to work, UDP packets inbound and outbound destined for port 5150 must be allowed. Source ports are dynamic, so, if possible, make this flexible, too. Additionally, PPTP and ATMP both require a firewall to allow GRE bi-directionally.

The following sections illustrate a sample filtering setup to allow either PPTP or ATMP traffic to cross a firewall:

- ["PPTP example" on page 4-20](#)
- ["ATMP example" on page 4-22](#)

Make your own appropriate substitutions. For more information on filters and firewalls, see [Chapter 10, "Security."](#)

## PPTP example

To enable a firewall to allow PPTP traffic, you must provision the firewall to allow inbound and outbound TCP packets specifically destined for port 1723. The source port may be dynamic, so often it is not useful to apply a compare function upon this portion of the control/negotiation packets. You must also set the firewall to allow inbound and outbound GRE packets, enabling transport of the tunnel payload.

From the Main Menu navigate to Display/Change IP Filter Set, and from the pop-up menu select **Basic Firewall**.



Select **Display/Change Input Filter**.

*Display/Change Input Filter screen*

#	Source IP Addr	Dest IP Addr	Proto	Src.Port	D.Port	On?	Fwd?
1	0.0.0.0	0.0.0.0	TCP	NC	=2000	Yes	No
2	0.0.0.0	0.0.0.0	TCP	NC	=6000	Yes	No

Select Input Filter 1 and press Return. In the Change Input Filter 1 screen, set the Destination Port information as shown below.

```

Change Input Filter 1

Enabled:                Yes
Forward:                Yes

Source IP Address:      0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:       0.0.0.0
Dest. IP Address Mask: 0.0.0.0

Protocol Type:          TCP
Source Port Compare...  No Compare
Source Port ID:         0
Dest. Port Compare...   Equal
Dest. Port ID:          1723
Established TCP Conns. Only: No
  
```

Select Input Filter 2 and press Return. In the Change Input Filter 2 screen, set the Protocol Type to allow GRE as shown below.

```

Change Input Filter 2

Enabled:                Yes
Forward:                Yes

Source IP Address:     0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:      0.0.0.0
Dest. IP Address Mask: 0.0.0.0

Protocol Type:         GRE

```

In the Display/Change Filter Set screen select **Display/Change Output Filter**.

*Display/Change Output Filter screen*

+ #	Source IP Addr	Dest IP Addr	Proto	Src.Port	D.Port	On?	Fwd?
1	0.0.0.0	0.0.0.0	TCP	NC	=1723	Yes	Yes
2	0.0.0.0	0.0.0.0	GRE	--	--	Yes	Yes

Select Output Filter 1 and press Return. In the Change Output Filter 1 screen, set the Protocol Type and Destination Port information as shown below.

```

Change Output Filter 1

Enabled:                Yes
Forward:                Yes

Source IP Address:     0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:      0.0.0.0
Dest. IP Address Mask: 0.0.0.0

Protocol Type:         TCP
Source Port Compare... No Compare
Source Port ID:        0
Dest. Port Compare...  Equal
Dest. Port ID:         1723
Established TCP Conns. Only: No

```

Select Output Filter 2 and press Return. In the Change Output Filter 2 screen, set the Protocol Type to allow GRE as shown below.

```

Change Output Filter 2

Enabled:                Yes
Forward:               Yes

Source IP Address:     0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:     0.0.0.0
Dest. IP Address Mask: 0.0.0.0

Protocol Type:         GRE
    
```

## ATMP example

To enable a firewall to allow ATMP traffic, you must provision the firewall to allow inbound and outbound UDP packets specifically destined for port 5150. The source port may be dynamic, so often it is not useful to apply a compare function on this portion of the control/negotiation packets. You must also set the firewall to allow inbound and outbound GRE packets (Protocol 47, Internet Assigned Numbers Document, RFC 1700), enabling transport of the tunnel payload.

From the Main Menu navigate to Display/Change IP Filter Set, and from the pop-up menu select **Basic Firewall**.



Select **Display/Change Input Filter**.

*Display/Change Input Filter screen*

+#	Source IP Addr	Dest IP Addr	Proto	Src.Port	D.Port	On?	Fwd
1	0.0.0.0	0.0.0.0	TCP	NC	=2000	Yes	No
2	0.0.0.0	0.0.0.0	TCP	NC	=6000	Yes	No

Select Input Filter 1 and press Return. In the Change Input Filter 1 screen, set the Destination Port information as shown below.

```
Change Input Filter 1

Enabled:                Yes
Forward:                Yes

Source IP Address:      0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:       0.0.0.0
Dest. IP Address Mask: 0.0.0.0

Protocol Type:          TCP
Source Port Compare...  No Compare
Source Port ID:         0
Dest. Port Compare...   Equal
Dest. Port ID:          1723
Established TCP Conns. Only: No
```

Select Input Filter 2 and press Return. In the Change Input Filter 2 screen, set the Protocol Type to allow GRE as shown below.

```
Change Input Filter 2

Enabled:                Yes
Forward:                Yes

Source IP Address:      0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:       0.0.0.0
Dest. IP Address Mask: 0.0.0.0

Protocol Type:          GRE
```

In the Display/Change Filter Set screen select **Display/Change Output Filter**.

*Display/Change Output Filter screen*

+ #	Source IP Addr	Dest IP Addr	Proto	Src.Port	D.Port	On?	Fwd?
1	0.0.0.0	0.0.0.0	TCP	NC	=1723	Yes	Yes
2	0.0.0.0	0.0.0.0	GRE	--	--	Yes	Yes

Select Output Filter 1 and press Return. In the Change Output Filter 1 screen, set the Protocol Type and Destination Port information as shown below.

```

Change Output Filter 1

Enabled:                Yes
Forward:                Yes

Source IP Address:      0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:       0.0.0.0
Dest. IP Address Mask:  0.0.0.0

Protocol Type:          UDP
Source Port Compare...  No Compare
Source Port ID:         0
Dest. Port Compare...   No Compare
Dest. Port ID:          5150
    
```

Select Output Filter 2 and press Return. In the Change Output Filter 2 screen, set the Protocol Type to allow GRE as shown below.

```

Change Output Filter 2

Enabled:                Yes
Forward:                Yes

Source IP Address:      0.0.0.0
Source IP Address Mask: 0.0.0.0

Dest. IP Address:       0.0.0.0
Dest. IP Address Mask:  0.0.0.0

Protocol Type:          GRE
    
```

## Windows Networking Broadcasts

Netopia firmware provides the ability to forward Windows Networking NetBIOS broadcasts. This is useful for, for example, a Virtual Private Network, in which you want to be able to browse the remote network to which you are tunnelling, as part of your Windows Network Neighborhood.

Routed connections, such as VPNs, can not use NetBEUI to carry the Network Neighborhood information. They need to use NetBIOS, because NetBEUI cannot be routed. This feature will allow browsing the Network Neighborhood without any additional workstation configuration.

You enable this feature in the **IP Profile Parameters** screen of your Connection Profile. The IP Profile Parameters screen varies slightly, depending on whether your model router connects directly to the Internet, or if it connects via an Ethernet connection through a cable or DSL modem. The enabling feature is the same for both:

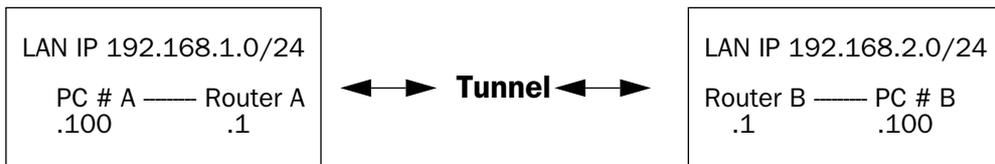
Using the Tab key, toggle **NetBIOS Proxy Enabled** from the default **No** to **Yes**, and press Return. Your remote Network Neighborhood becomes accessible from your Windows desktop.

---

**Note:** The remote IP address and subnet mask should strictly match the IP address and subnet mask configured on the LAN interface of the remote router. See the following example.

---

### Example:



When PC #A sends a Windows networking broadcast it sends it with a destination IP 192.168.1.255.

When Router A receives this broadcast it translates the destination of this broadcast to match the remote IP of the NetBIOS Proxy-enabled VPN profiles and it forwards the broadcast through the VPN tunnel.

When Router B receives this broadcast, it sends it on its LAN.

Configuration for Router A

IP Profile Parameters

Address Translation Enabled: No

Remote IP Address: 192.168.2.1  
Remote IP Mask: 255.255.255.0

Filter Set...  
~~Remove Filter Set~~

**NetBIOS Proxy Enabled Yes**

RIP Profile Options...

Enter an IP address in decimal and dot form (xxx.xxx.xxx.xxx).  
Configure IP requirements for a remote network connection here.

Configuration for Router B

IP Profile Parameters

Address Translation Enabled: No

Remote IP Address: 192.168.1.1  
Remote IP Mask: 255.255.255.0

Filter Set...  
~~Remove Filter Set~~

**NetBIOS Proxy Enabled Yes**

RIP Profile Options...

Enter an IP address in decimal and dot form (xxx.xxx.xxx.xxx).  
Configure IP requirements for a remote network connection here.

---

**Note:** Microsoft Network browsing is available with or without a Windows Internet Name Service (WINS) server. Shared volumes on the remote network are accessible with or without a WINS server. Local LAN shared volumes that have Port Address Translation (PAT) applied to them are *not* available to hosts on the remote LAN. For tunnelled traffic, NAT on the WAN has no effect on the Microsoft Networking traffic.

Make sure the NetBIOS filter is not enabled in your Internet Connection Profile.

Netopia includes the NetBIOS Proxy feature as an enhancement and convenience for our customers. It has been lab-tested and many customers use it successfully. However, Netopia cannot guarantee that this feature will automatically give you the networking functionality you expect. There are many possible issues with the various Windows operating systems that may prevent NetBIOS from functioning as described above. Netopia Technical Support does not troubleshoot problems customers may encounter with their Windows operating system

---



## Chapter 5

# Internet Key Exchange (IKE) IPsec Key Management for VPNs

IPsec stands for IP Security, a set of protocols that supports secure exchange of IP packets at the IP layer. IPsec is deployed widely to implement Virtual Private Networks (VPNs). See “[Virtual Private Networks \(VPNs\)](#)” on page 4-1 for more information.

The Version 5.3 firmware supports Internet Key Exchange (IKE) for secure encrypted communication over a VPN tunnel.

This chapter covers the following topics:

- “[Overview](#)” on page 5-1
- “[Internet Key Exchange \(IKE\) Configuration](#)” on page 5-2
- “[Key Management](#)” on page 5-9
- “[IPsec WAN Configuration Screens](#)” on page 5-18
- “[IPsec Manual Key Entry](#)” on page 5-19

---

## Overview

IPsec supports two encapsulation modes: Transport and Tunnel. Transport mode encrypts only the data portion (payload) of each packet, but leaves the header untouched. Tunnel mode encrypts both the header and the payload. On the receiving side, an IPsec-compliant device decrypts each packet. Netopia Routers support Tunnel mode.

DES stands for Data Encryption Standard, a popular symmetric-key encryption method. DES uses a 56-bit key. Netopia Routers offer IPsec 3DES (triple DES) encryption as a standard option.

---

**Note:** Some models support built-in hardware acceleration of 3DES encryption at line speeds. The optional VPN-accelerated models (all 4652 models and 4522 routers whose model number ends in “-**XL**”) accelerate IPsec encryption and authentication.

---

*Internet Key Exchange (IKE)* is an authentication and encryption key management protocol used in conjunction with the IPsec standard.

IKE is a two-phase protocol for key exchange.

- Phase 1 authenticates the security gateways and establishes the *Security Parameters* (SPs) they will use to negotiate on behalf of the clients. *Security Associations* (SAs) are sets of information values that allow

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the two devices on the Internet to communicate securely.

- Phase 2 establishes the tunnel and provides for secure transport of data.

IPsec can be configured without IKE, but IKE offers additional features, flexibility, and ease of configuration. Key exchange between your local router and a remote point can be configured either manually or by using the key exchange protocol.

The advantage of using IKE is that it automatically negotiates IPsec Security Associations and enables IPsec secure communications without having to manually enter the lengthy encryption keys at both ends of the connection. You enter a human-readable pass phrase or shared secret English sentence, like “my dog has fleas” on each end once. This pass phrase is used to authenticate each end to the other. Thereafter, the two ends periodically use a public key encryption method called Diffie-Hellman to exchange key material and then securely generate new authentication and encryption keys. The keys are automatically and continually changing, making the data exchanged using the keys inherently secure.

It also allows you to specify a lifetime for the IPsec Security Association and allows encryption keys to change periodically during IPsec sessions. You can set this period for key generation to as often as your security requirements dictate.

A *Security Policy Database (SPD)* now defines the security requirements. This is a significant change from earlier firmware implementations of IPsec. Traffic with a source IP address that falls within the local member specification of an IPsec tunnel and that is addressed to a destination IP address that falls within the remote member specification of that tunnel is not routed using the normal routing table. Instead it is forwarded using the security policy database to the remote security gateway (remote tunnel endpoint) specified in the IPsec tunnel configuration. It is not possible to send traffic outside the tunnel by bypassing the tunnel and the remote security gateway.

---

**Note:** To fully protect against IP address “spoofing” of local member addresses requires firewall rules to be installed on the WAN interface. These must prevent packets coming in through that interface with local member source addresses, since local member source addresses should only originate from the LAN. Otherwise it is theoretically possible for a malicious hacker to send packets through the tunnel by impersonating local member IP addresses. See the chapter [“Security” on page 10-1](#) for more information.

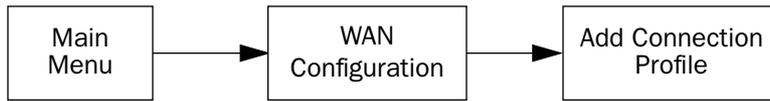
Traffic originating from local member LAN addresses that is not addressed to remote member addresses, as well as traffic originating from local LAN IP addresses that do not match any local member specifications, is routed using the normal routing table. This means that if you want to restrict traffic from local members from going out to the Internet and force it all to go through one or more tunnels you need to specify remote members of 0.0.0.0 - 255.255.255.255 or 0.0.0.0/0. Traffic originating from the router, for example, telnet, ping, DNS queries, will not use the default VPN definition even if the source addresses match. Traffic to and from the router is included in specific VPNs.

---

## *Internet Key Exchange (IKE) Configuration*

IPsec tunnels are defined in the same manner as PPTP tunnels. (See [“Virtual Private Networks \(VPNs\)” on page 4-1](#) for more information.) You configure the Connection Profile as follows.

From the Main Menu navigate to WAN Configuration and then Add Connection Profile.



The Add Connection Profile screen appears.

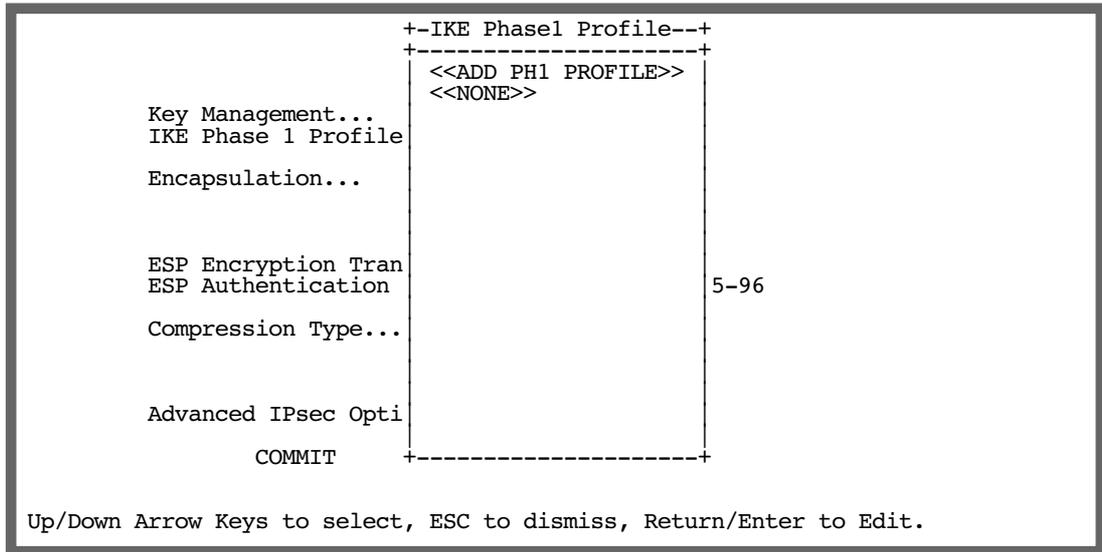
Add Connection Profile	
Profile Name:	Profile 1
Profile Enabled:	+-----+
Encapsulation Type...	+-----+
Encapsulation Options...	PPP
	HDLC
	Frame Relay
	RFC1483
	ATMP
	PPTP
	IPsec
	+-----+
IP Profile Parameters...	
Interface Group...	Primary
COMMIT	CANCEL

- From the **Encapsulation Type** pop-up menu select **IPsec**.
- Then select **Encapsulation Options**. The IPsec Tunnel Options screen appears.

IPsec Tunnel Options	
Key Management...	IKE
IKE Phase 1 Profile...	
Encapsulation...	ESP
ESP Encryption Transform...	DES
ESP Authentication Transform...	HMAC-MD5-96
Compression Type...	None
Advanced IPsec Options...	
COMMIT	CANCEL

For **Key Management** you can use either **IKE** or **Manual**. If you choose Manual, skip to “IPsec Manual Key Entry” on page 5-19. If you choose IKE (the default) continue below.

- Select **IKE Phase 1 Profile** and press Return.



- A pop-up window displays a list of IKE Phase 1 Profiles that you have configured. If you have not previously configured an IKE Phase 1 Profile, the selection **ADD PH1 PROFILE** allows you to do that now.

## Adding an IKE Phase 1 Profile

IKE Phase 1 Profiles contain the information that the two ends of a tunnel use to authenticate each other and the parameters that govern the public key cryptography exchanges that are required to generate new keys periodically. Make sure to add an IKE Phase 1 Profile. If an IKE Phase 1 Profile is not assigned to an IKE Connection Profile, all VPN traffic for that profile will be discarded.

Select **ADD PH1 PROFILE**. The Add IKE Phase 1 Profile screen appears.

Add IKE Phase 1 Profile	
Profile Name:	IKE Profile 1
Mode...	Aggressive Mode
Local Identity Type...	IPv4 Address
Local Identity Value:	0.0.0.0
Remote Identity Type...	IPv4 Address
Remote Identity Value:	0.0.0.0
Authentication Method...	Shared Secret
Shared Secret:	*****
Encryption Algorithm...	des
Hash Algorithm...	md5
Diffie-Hellman Group...	Group 2 (1024 bits)
Advanced IKE Phase 1 Options...	
ADD IKE PHASE 1 PROFILE	CANCEL

- The **Profile Name** field accepts any name of up to 16 characters. Sixteen IKE Phase 1 profiles are supported, since each of the potential sixteen Connection Profiles may be associated with a separate IKE Phase 1 profile.
- The **Mode** pop-up menu allows you to choose between Main Mode (the default) and Aggressive Mode.
- In **Main Mode** the router hides the **Local** and **Remote Identity Type** and **Value** fields, defaults to the host address, and always uses the IPV4 Address and the local and remote tunnel endpoint address.
- In **Aggressive Mode** the **Local** and **Remote Identity Type** pop-up menus allow you to choose the type of Identity value to use: IPv4 Address, IPv4 Subnet, IPv4 Range, Host Name, E-Mail Address, Key ID (ASCII), and Key ID (HEX). The **Local** and **Remote Identity Type** and **Value** menus allow you to specify one of the following, based on what Local Identity Type you selected in the previous pop-up menu:
  - IPv4 Address:** A single IPv4 address in the familiar dotted-quad notation (a.b.c.d).
  - IPv4 Subnet:** A single IPv4 network address in dotted-quad notation (a.b.c.d) followed by a mask specified *either* by a slash and a bit-count between 0 and 32 OR by a second dotted-quad.
  - IPv4 Range:** Two IPv4 addresses in dotted quad notation (a.b.c.d) separated by a space.
  - Host Name:** A fully-qualified domain name (FQDN).
  - E-Mail Address:** An RFC 822 e-mail address in the form *user@hostname*.
  - Key ID (ASCII):** An opaque string consisting of printable ASCII characters represented as a sequence of printable ASCII characters.
  - Key ID (HEX):** An opaque string consisting of arbitrary 8-bit ASCII values represented as a sequence of hexadecimal digits, each of which corresponds to one nibble of the string value.
- The **Authentication Method** pop-up menu specifies the IKE Phase 1 authentication method. The only currently supported authentication method is Shared Secret. Other methods may be supported in future firmware releases.
- The **Shared Secret** field allows you to enter a shared secret phrase (between 1 and 48 characters long)

that will be used to generate key material for IKE Phase 1.

- The **Encryption Algorithm** pop-up menu specifies the IKE Phase 1 encryption algorithm, and may be either DES (the default) or 3DES.
- The **Hash Algorithm** pop-up menu specifies the IKE Phase 1 hash algorithm, and may be either SHA1 (the default) or MD5.
- The **Diffie-Hellman Group** pop-up menu specifies the IKE Phase 1 Diffie-Hellman key exchange size, and may be either Group 1 (768 bits), Group 2 (1024 bits) (the default), or Group 5 (1536 bits).
- If you select **Advanced IKE Phase 1 Options** the Advanced IKE Phase 1 Options screen appears.

Advanced IKE Phase 1 Options

Negotiation...	Normal
SA Use Policy...	Newest SAs Immediately
Allow Dangling Phase 2 SAs:	Yes
Phase 1 SA Lifetime (seconds):	28800
Phase 1 SA Lifetime (Kbytes):	0
Send Initial Contact Message:	Yes
Include Vendor ID Payload:	Yes
Independent Phase 2 Re-keys:	Yes
Strict Port Policy:	No

Return/Enter accepts \* Tab toggles \* ESC cancels.

Normally it is not necessary to change the settings of the items on the Advanced IKE Phase 1 Options screen. Most of these settings exist for ensuring compatibility with remote IKE implementations that may have certain limitations.

- The **Negotiation** pop-up menu allows you to specify the way the device will respond to a connection attempt. Normal (the default) is a two-way mode; Initiate Only or Respond Only permit limiting the connection to one-way only.
- The **SA Use Policy** pop-up menu specifies the policy that the router will use to determine which Phase 1 SAs to use when multiple valid Phase 1 SAs are available for transmitting traffic on an IPsec tunnel.  
Because the router normally re-keys prior to the expiration of the current Phase 1 SAs, multiple valid Phase 1 SAs may exist during the period of time after the router has re-keyed and established new Phase 1 SAs and the time at which the old Phase 1 SAs expire.
  - If you select **Newest SAs Immediately**, the router will begin using the newly created Phase 1 SAs immediately after they are negotiated.
  - If you select **Old SAs Until Expired**, the router will continue using the old Phase 1 SAs until they expire and will begin using the newly created Phase 1 SAs only after the old ones are no longer valid.
- **Allow Dangling Phase 2 SAs** toggles whether or not Phase 2 SAs are permitted to survive the expiration of

the Phase 1 SAs under which they were created. Phase 2 SAs “dangle” when the Phase 1 SA under which they were created expires before they do. There is no requirement that the Phase 1 SA exist for the duration of the Phase 2 SA’s lifetime, but it is convenient because a Delete message may be sent.

- The two SA Lifetime items specify the lifetime associated with each Phase 1 SA and control when the SA will expire and become invalid.
  - **Phase 1 SA Lifetime (seconds)** specifies the duration in seconds for which the SA will remain valid. The range of permissible values is the set of non-negative integer values between 0 and  $2^{32}-1$ . The default value is 28,800 seconds. The value zero specifies the default.
  - **Phase 1 SA Lifetime (Kbytes)** specifies the maximum number of kilobytes of data that may be secured (encrypted/decrypted or authenticated) using the SA before it expires and becomes invalid. The range of permissible values is the set of non-negative integer values between 0 and  $2^{32}-1$ . The default value is 0 Kilobytes. The value zero specifies the absence of a secured data lifetime.

---

**Note:** It is invalid to set both lifetime values to zero. This condition is not enforced by the console (in order to avoid order dependencies when configuring the items), but will set defaults at runtime.

---

- **Send Initial Contact Message** toggles whether or not the IKE negotiation process begins by sending an initial contact message. The default is **Yes**.
- **Include Vendor-ID Payload** toggles whether or not the router includes the vendor-ID payload in its IKE Phase 1 messages.
- **Independent Phase 2 Re-keys** toggles whether or not a Phase 2 re-keys requires a Phase 1 re-key. If this item is set to Yes (the default), Phase 2 re-keys will be performed independently when necessary without requiring a Phase 1 re-key. If this item is set to No, each Phase 2 re-key will be preceded by a Phase 1 re-key. This item should normally be set to Yes unless the device is communicating with a non-compliant remote IPsec peer that requires that a Phase 1 re-key precede each Phase 2 re-key.
- **Strict Port Policy** toggles whether or not IKE requires packets to originate from the IANA IKE port (500). Set to **Yes**, the router will listen only to port 500 and source its packets from port 500. Set to **No**, the router will return traffic to whatever port originated it.

## Changing an IKE Phase 1 Profile

Selecting **Display/Change IKE Phase 1 Profile** or **Delete IKE Phase 1 Profile** displays an IKE Phase 1 profile pop-up menu listing the names of all currently defined IKE Phase 1 profiles:

```

IPsec Configuration
+--IKE Phase1 Profile--+
+-----+
D | IKE Profile 2          | l Profile...
A | Arthropods            | .
D | Anthropoids           | e...
  | Anopheles
  | Albigensians
+-----+

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

Selecting **Display/Change IKE Phase 1 Profile** and choosing an IKE phase 1 profile name from the pop-up list displays the Change IKE Phase 1 Profile screen. This screen is identical to the Add IKE Phase 1 Profile screen shown above.

Selecting **Delete IKE Phase 1 Profile** and choosing an IKE phase 1 profile name from the pop-up list displays a confirmation alert asking you to confirm that you really want to delete the specified IKE phase 1 profile:

```

IPsec Configuration
+--IKE Phase1 Profile--+
Display+-----+
Add IKE| Netopia    |
+-----+
Are you sure you want to delete this IKE Phase 1 Profile?
      CANCEL                      CONTINUE
+-----+

```



**Note:** The Change Connection Profile screen will offer different options, depending on the model of router you are using. For a router with the Dial Backup feature, you can associate an IPsec profile with the Primary, the Backup, or choose to apply it to Any Port of the WAN interface by choosing the interface from the Interface Group pop-up menu as shown below.

Add Connection Profile

Profile Name:	Profile 1
Profile Enabled:	Yes
Encapsulation Type...	IPsec
Encapsulation Options...	
IP Profile Parameters...	
Interface Group...	<div style="border: 1px dashed black; padding: 5px; text-align: center;">Primary Backup Any Port</div>
COMMIT	CANCEL

From the Encapsulation Type pop-up menu, select **IPsec**. Then select **Encapsulation Options** and press Return. The IPsec Tunnel Options screen appears.

IPsec Tunnel Options

Key Management...	IKE
IKE Phase 1 Profile...	
Encapsulation...	ESP
ESP Encryption Transform...	DES
ESP Authentication Transform...	HMAC-MD5-96
Advanced IPsec Options...	
COMMIT	CANCEL

The **Key Management** pop-up menu at the top of the IPsec Tunnel Options screen allows you to choose between IKE key management (the default for a new IPsec profile) and Manual key management.

If you select **Manual**, the IKE Phase 1 Profile option does not display, and you must enter your IPsec Manual Keys under the IPsec Manual Keys screen. See [“IPsec Manual Key Entry” on page 19](#).

- The **IKE Phase 1 Profile** pop-up menu allows you to associate an IKE Phase 1 Profile with the IPsec tunnel. An IKE Phase 1 Profile specifies the set of parameters that will be used for the IKE Phase 1 exchange. IKE Phase 1 Profiles may be shared by multiple IPsec tunnels. The pop-up menu item displays the name of the currently associated IKE Phase 1 Profile, if any, or is blank if no IKE Phase 1 profile is associated with the tunnel.

The pop-up menu lists the names of all currently defined IKE Phase 1 Profiles. The pop-up menu also includes an <<ADD PH1 PROFILE>> item to allow you to define a new IKE Phase 1 Profile directly without first going to the IPsec Configuration screen, and a <<NONE>> item to allow you to dissociate an existing IKE Phase 1 Profile from the IPsec tunnel.

The remainder of the screen allows you to configure the IKE Phase 2 parameters that control the contents of the single IKE Phase 2 proposal sent by the router. These same items specify the values that must be offered by one of the remote peer’s proposals.

- The **Encapsulation** pop-up menu allows you to select what IPsec encapsulations will be used: ESP only (the default), AH only, or AH+ESP (both AH and ESP).
- An **AH Authentication Transform** pop-up menu (which is visible only if you have selected AH or AH+ESP encapsulation) allows you to specify the type of AH authentication: HMAC-MD5-96 or HMAC-SHA1-96.
- The **ESP Encryption Transform** pop-up menu (which is visible only if you have selected ESP or AH+ESP encapsulation) allows you to specify the type of ESP encryption: DES, 3DES, or NULL (no encryption).
- The **ESP Authentication Transform** pop-up menu (which is visible only if you have selected ESP or AH+ESP encapsulation) allows you to specify the type of ESP authentication: None, HMAC-MD5-96, or HMAC-SHA1-96.

If you select **Advanced IPsec Options**, the Advanced IPsec Options screen appears.

Advanced IPsec Options	
SA Lifetime seconds:	28800
SA Lifetime Kbytes:	0
Perfect Forward Secrecy:	Yes
Dead Peer Detection:	No

This screen allows you to specify the lifetime associated with each IPsec Security Association (SA) and control when the SA will expire and become invalid.

- **SA Lifetime (seconds)** specifies the duration in seconds for which the SA will remain valid. The range of permissible values is the set of non-negative integer values between 0 and  $2^{32}-1$ . The default value is 28,800 seconds (1 hour). The value zero specifies the absence of an elapsed time lifetime.
- **SA Lifetime (Kilobytes)** specifies the maximum number of kilobytes of data that may be secured (encrypted/decrypted or authenticated) using the SA before it expires and becomes invalid. The range of permissible values is the set of non-negative integer values between 0 and  $2^{32}-1$ . The default value is 0 Kilobytes. The value zero specifies the absence of a secured data lifetime.

---

**Note:** It is invalid to set both lifetime values to zero! This condition is not enforced by the console (in order to avoid order dependencies when configuring the items), but rather is enforced at runtime and will cause the IPsec profile to assume the defaults.

---

- **Perfect Forward Secrecy** toggles whether or not Perfect Forward Secrecy will be used. Enabling Perfect Forward Secrecy (the default) causes IKE to perform a new Diffie-Hellman exchange with each Phase 2 re-key. Because the additional Diffie-Hellman exchanges required for Perfect Forward Secrecy introduce additional overhead, it may be good to disable Perfect Forward Secrecy when security does not require it.
- **Dead Peer Detection** toggles whether or not the router will detect a remote peer being offline.

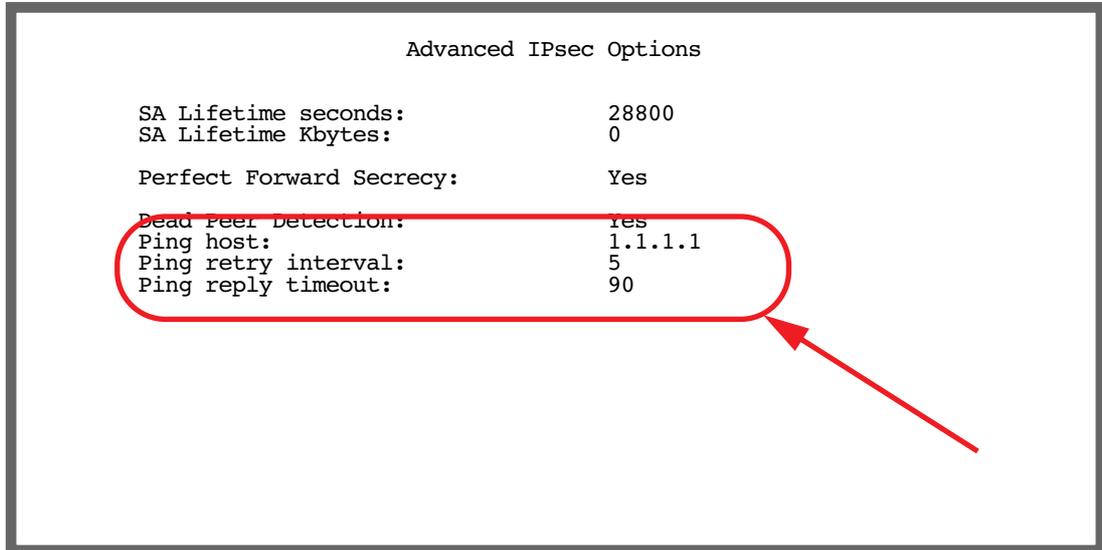
### ***Enhanced Dead Peer Detection***

Netopia Firmware Version 5.4 adds a new Dead Peer Detection mechanism.

In previous firmware versions, when Dead Peer Detection was enabled, a counter would begin in the router when any traffic was sent through the tunnel. Determination of a dead peer could take up to eight minutes.

Netopia Firmware Version 5.4 provides a new Dead Peer Detection mechanism. An IPsec IP net interface sends ICMP ping requests to a specific IP address on a Remote Member network. The ping is periodic, and the reply is expected within a certain amount of time. If the ICMP reply does not arrive within that time, the peer is considered dead, the current phase 2 SAs are torn down, and the IKE SA starts a new phase 1 negotiation, followed by the normal phase 2 negotiation, thereafter.

When you toggle **Dead Peer Detection** to **Yes** (on), new options appear.



- **Ping host** allows you to specify the host IP address of the host to ping, and from which replies will be expected.

This field is only available if you have previously configured, and **committed**, remote network IP data in the Add Network Configuration screen under Advanced IP Profile Options. See [“Add Network Configuration” on page 5-15](#).

- **Ping retry interval** and **Ping reply timeout** options appear.

The defaults are 5 seconds and 90 seconds, respectively. You may adjust these to suit your network’s tolerances.

---

### Note:

- ICMP Dead Peer Detection is not available when using manual re-keying.
  - ICMP Dead Peer Detection does not initiate a series of phase 2 exchanges upon detecting a dead peer; it instead initiates a new phase 1 negotiation, followed by a new phase 2 negotiation once contact with the peer has been re-established.
  - If you are using Multiple Network IPsec, the IP address of the ICMP Dead Peer Detection mechanism must be constrained to the set of network ranges defined for the IPsec profile.
- 

Press Escape to return to the Add or Change Connection Profile screen, and select **IP Profile Parameters**.

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If you enable IKE key management the IP Profile Parameters screen appears.

IP Profile Parameters

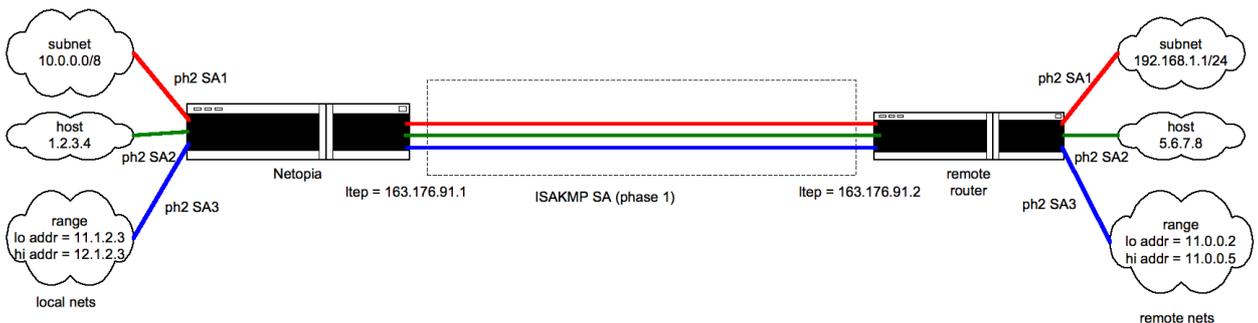
Remote Tunnel Endpoint:	0.0.0.0
Add Network...	
Address Translation Enabled:	No
Filter Set...	<<None>>
Remove Filter Set	
Advanced IP Profile Options...	
COMMIT	CANCEL

- The **Remote Tunnel Endpoint** field accepts either an IP address in the familiar dotted–quad notation a.b.c.d or a hostname to be resolved using the Domain Name System (DNS).

### Multiple Network IPsec

Netopia Firmware Version 5.4 offers an enhancement to IPsec VPN tunnels allowing multiple network support. This feature enhances your Netopia Router's Virtual Private Networking functionality.

This feature allows you to define many local and remote network ranges for a given IPsec VPN profile. Each of these ranges has its own IPsec tunnel. However, each tunnel has a common tunneling endpoint and encryption policy. This is useful, for example, for branch office management of multiple IP subnets over an encrypted VPN tunnel. The following diagram illustrates this feature:



Advantages of Multiple Network IPsec are:

- scalability
- flexibility, by adding any combination of remote/local network ranges

- support for sub-netting, host and network range addressing modes
- works with manual keying and Internet Key Exchange (IKE)
- each IPsec network works under the same local/remote tunnel endpoints
- Select **Add Network** and press Return. The Add Network Configuration screen appears.

Add Network Configuration

Remote Member Format... Remote Member Address: Remote Member Mask: Local Member Format... Local Member Address: Local Member Mask:	Subnet Range Host Address  0.0.0.0 0.0.0.0
---	---

COMMIT
CANCEL

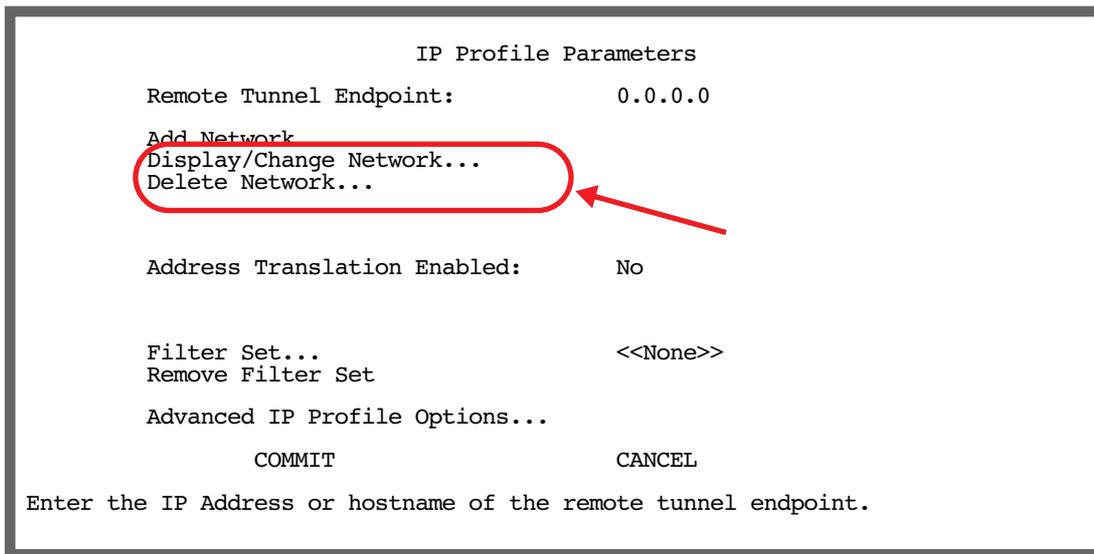
- The **Remote Member Format** and **Local Member Format** pop-up menus allow you to choose a format for your network end points: Subnet, Range, or a single Host Address.
  - If you choose **Subnet**, you must enter the **Remote Member Address** and the subnet mask that is the **Remote Member Mask**.  
Enter the **Local Member Address** and the **Local Member Mask** in their respective fields.
  - If you choose **Range**, the next two fields become **Remote Member 1st Address** and **Remote Member Last Address**. You supply these values.  
Complete the **Local Member 1st Address** and **Local Member Last Address** fields.
  - If you choose **Host Address**, you need only supply the **Remote Member Address** and the **Local Member Address**; the other fields are hidden.
- Select **COMMIT** and press Return to add the configuration. This returns you to the IP Profile Parameters screen. Select **COMMIT** and press Return in the IP Profile Parameters screen. This returns you to the Change Connection Profile screen. Select **COMMIT** and press Return in the Change Connection Profile screen.

---

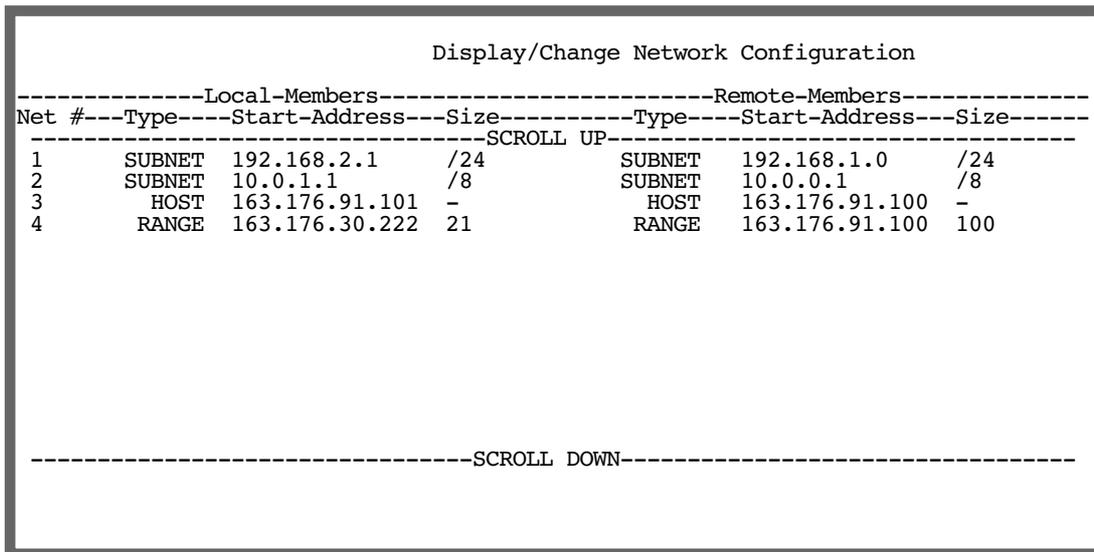
### Note:

- Any two IPsec tunnels differ only by the local/remote networks they are intended to reach; they have the same encryption policy, which is derived from the base profile.
  - The feature is limited to 8 networks per tunnel.
-

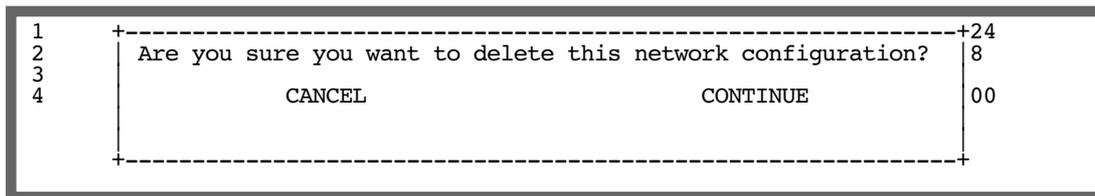
If you return to the IP Profile Parameters screen, two new fields are displayed:



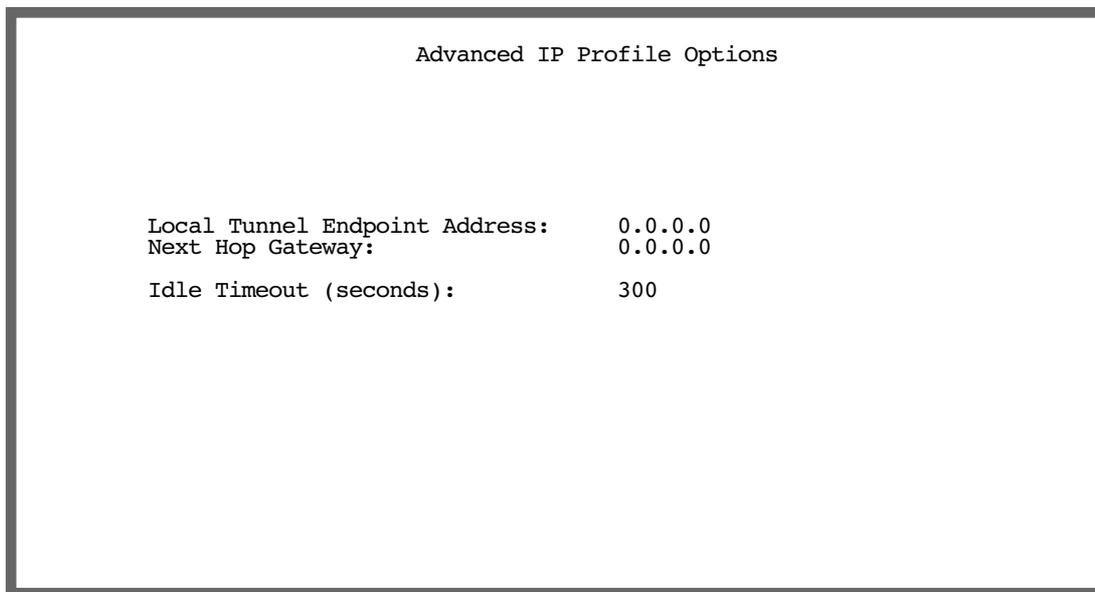
- **Display/Change Network** allows you to make changes to existing network configurations you have made. If you select Display/Change Network, a list of your configured networks displays.



- Scroll down and up with the arrow keys to select the one you want to change, and press Return. You will be returned to the Network Configuration screen where you can make any required changes.
- If you select **Delete Network** in the IP Profile Parameters screen, the same scrolling list will display. When you select one of the networks and press Return, a warning screen will ask you to confirm your choice:



- Specifying IKE key management alters the **Advanced IP Profile Options** screen as follows:



- You can specify a **Local Tunnel Endpoint Address**. If not 0.0.0.0, this value must be one of the assigned interface addresses, either WAN or LAN. This is used as the source address of all IPsec traffic.
- You can specify a **Next Hop Gateway**. If you specify the Remote Tunnel Endpoint Address, and the address is in the same subnet as the Remote Members Network you specified in the IP Profile Parameters, the **Next Hop Gateway** option allows you to enter the address by which the gateway partner is reached. If you do not specify the Remote Tunnel Endpoint Address, the router will use the default gateway to reach the partner. If the partner should be reached via an alternate port (for example, the LAN instead of the WAN), the **Next Hop Gateway** field allows this path to be resolved.
- You can specify an **Idle Timeout (seconds)** value. The idle timeout tells the router that if no traffic passes through the tunnel for the specified number of seconds, no automatic SA re-key should be performed. When new traffic does pass through the tunnel, the idle timeout interval resets again when the current SAs expire.

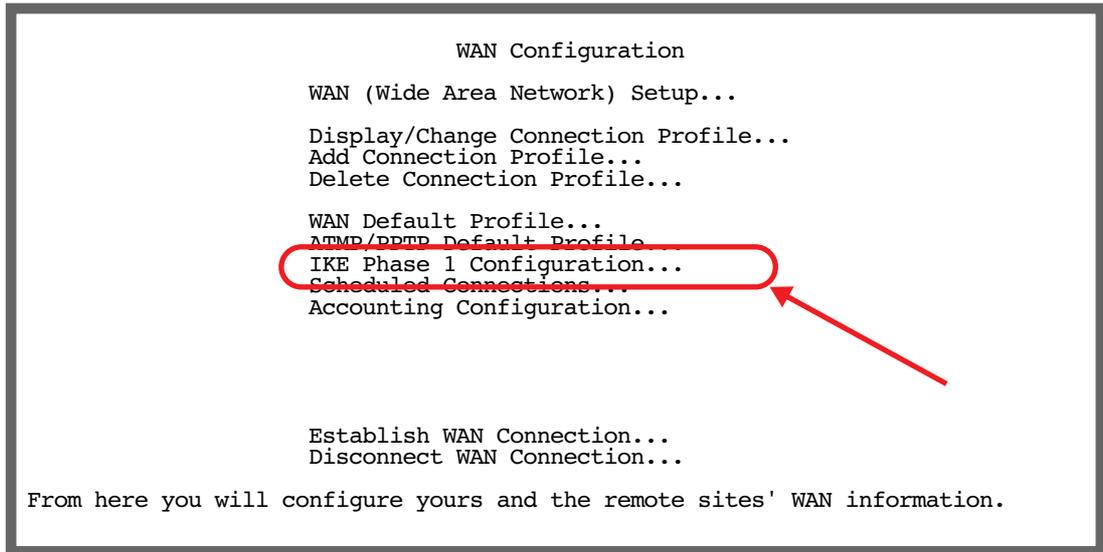
If you set the value to zero, the router will re-key the SA whenever the SA Lifetime interval specifies, regardless of whether traffic is passing through it or not. This will effectively “nail up” the tunnel.

## IPsec WAN Configuration Screens

You can also configure IKE Phase 1 Profiles in the WAN Configuration menus.

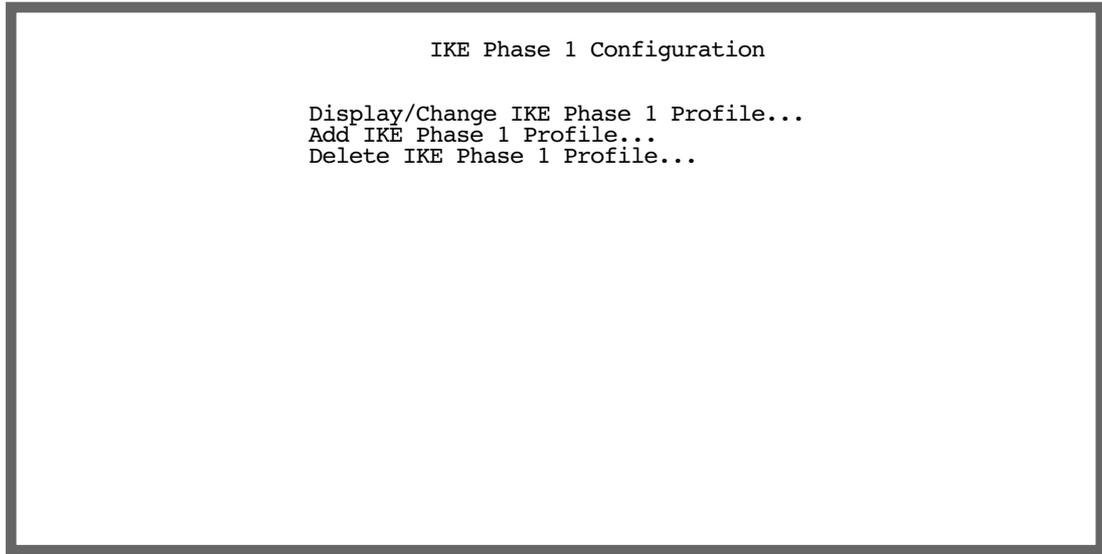


The WAN Configuration screen now includes IKE Phase 1 Configuration as shown:



Select **IKE Phase 1 Configuration** and press Return.

The IKE Phase 1 Configuration screen appears.

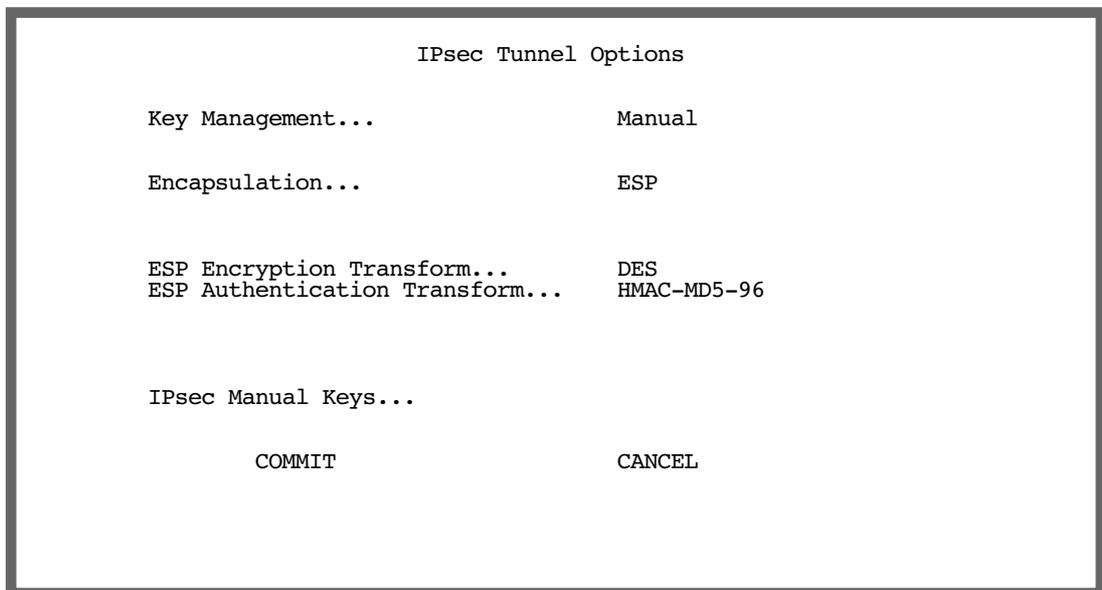


The IKE Phase 1 Configuration screen allows configuration of global (non-connection-profile-specific) IPsec parameters. This screen allows you to Display, Change, Add, or Delete an IKE Phase 1 profile.

---

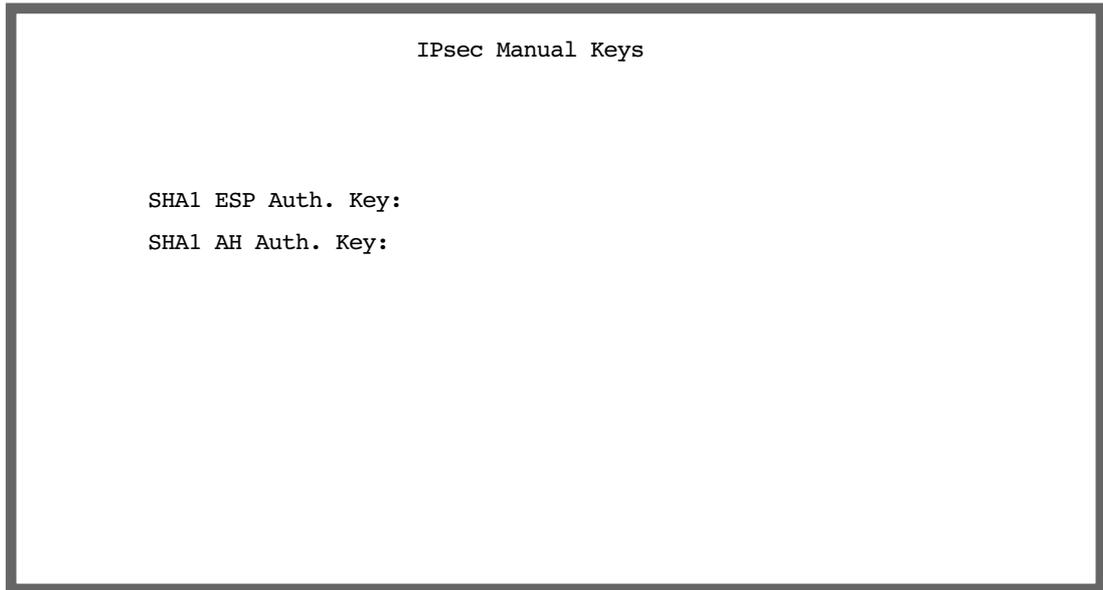
## *IPsec Manual Key Entry*

The Version 5.3 firmware has a redesigned layout and additional options for manual key entry. If you selected Manual Key Management in the IPsec Tunnel Options screen, you will need to enter your encryption keys in the IPsec Manual Keys screen.



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Select **IPsec Manual Keys** and press Return.

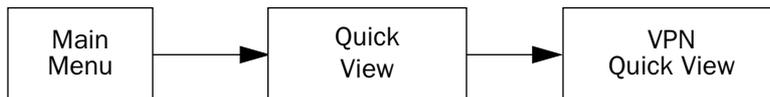


Depending on your selections of Encapsulation, Encryption Transform, and Authentication Transform in the IPsec Tunnel Options screen, the IPsec Manual Keys screen will display differing entry fields to enter authorization keys and encryption keys.

With Manual Keys, you must manually configure identical authentication and encryption keys at both ends of the tunnel. The authentication keys are either 32 (for MD5) or 40 (for SHA1) ascii hex characters, while the encryption keys are 16 (for DES) or 48 (for triple-DES) ascii-hex characters.

## VPN Quickview

Statistics are displayed on the VPN Quick View screen.



The VPN Quick View screen has been modified slightly in firmware version 5.3.

VPN Quick View						
Profile Name-----	Type--	Rx Pckts--	Tx Pckts--	Discard--	Remote Address--	
HA <-> FA1 (Jony Fon	ATMP	99	99		173.166.82.8	
HA <-> FA3 (Sleve M.	ATMP	13	14		63.193.117.91	
My IPsec Tunnel	IPsec	23	12		0.0.0.0 ←	
Bangalore	PPTP	45	35		1.1.1.1	

If the remote tunnel end point is a hostname (or “0.0.0.0”) 0.0.0.0 is displayed until a Security Association is established. Previously the remote members network was displayed.

## WAN Event History Error Reporting

The following events are logged and displayed in the WAN Event History screen:

Event message:	Meaning:
IKE: no ph1 preferences assigned	An attempt was made to use an IPsec profile with no IKE profile attached to it.
IKE: DNS lookup failure	The DNS lookup of the remote tunnel end point has failed.
IKE: no matching ph1 profile	An IKE phase 1 request was received and did not match any of the profiles stored in the local router.
IKE: no matching proposal	An IKE phase 1 request was received and the proposal did not match an allowed parameter, or else the remote rejected the local router’s proposal.
IKE: phase 1 auth failure	The phase 1 remote authentication failed.
IKE: phase 1 resend timeout	The attempt to resend the phase 1 remote authentication timed out.
IKE: phase 1 complete	The phase 1 negotiation completed successfully.
IKE: phase 2 hash failure	The phase-2 hash failed because the data received is out of date or has been tampered with.

<b>Event message:</b>	<b>Meaning:</b>
IKE: no matching ph2 proposal	Either the local router rejected the proposals of the remote or the remote rejected the local router's.
IKE: ph2 resend timeout	The attempt to resend the phase 2 authentication timed out.
IKE: phase 2 complete	The phase 2 negotiation completed successfully.

# Chapter 6

## IP Setup

The Netopia Firmware Version 5.4 uses Internet Protocol (IP) to communicate both locally and with remote networks. This chapter shows you how to configure the router to route IP traffic. You also learn how to configure the router to serve IP addresses to hosts on your local network.

Netopia's IP routing features Network Address Translation and IP address serving.

This section covers the following topics:

- [“IP Setup” on page 6-2](#)
- [“RIP-2 MD5 Authentication” on page 6-10](#)
- [“IP Address Serving” on page 6-17](#)
- [“More Address Serving Options” on page 6-24](#)
- [“DHCP Relay Agent” on page 6-30](#)
- [“Connection Profiles” on page 6-32](#)
- [“Multicast Forwarding” on page 6-34](#)

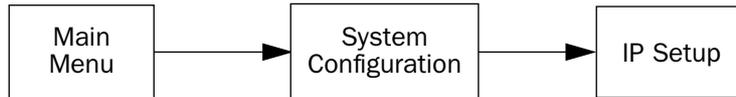
Network Address Translation allows communication between the LAN connected to the Router and the Internet using a single (or a few) IP address(es) instead of a routed account with separate IP addresses for each computer on the network.

Network Address Translation also provides increased security by hiding the local IP addresses of the LAN connected to the Netopia routers from the outside world.

The setup is simpler, so ISPs typically offer Internet accounts supporting Network Address Translation at a significant cost savings.

For a detailed discussion of Network Address Translation, see [Chapter 3, “Multiple Network Address Translation.”](#)

## IP Setup



The IP Setup options screen is where you configure the Ethernet side of the Router. The information you enter here controls how the router routes IP traffic.

Consult your network administrator or ISP to obtain the IP setup information (such as the Ethernet IP address, Ethernet subnet mask, default IP gateway, and Primary Domain Name Server IP address) you will need before changing any of the settings in this screen. Changes to these settings that you make in this screen will take effect only after the Netopia device is reset.

To go to the IP Setup options screen, from the Main Menu, select **System Configuration**, then **IP Setup**.

The IP Setup screen appears.

```

                                     IP Setup

Ethernet IP Address:                  192.128.117.162
Ethernet Subnet Mask:                255.255.255.0
Define Additional Subnets...

Default IP Gateway:                  192.128.117.163
Backup IP Gateway:                   0.0.0.0
Primary Domain Name Server:          0.0.0.0
Secondary Domain Name Server:        0.0.0.0
Domain Name:                          yourdomain.com

RIP Options...

Multicast Forwarding...              None

Static Routes...                     IP Address Serving...
```

Follow these steps to configure IP setup for your Router:

- Select **Ethernet IP Address** and enter the IP address for the Router's Ethernet port.
- Select **Ethernet Subnet Mask** and enter the subnet mask for the Ethernet IP address that you entered in the last step.
- If you desire multiple subnets select **Define Additional Subnets**. If you select this item you will be taken to the IP Subnets screen. This screen allows you to define IP addresses and masks for additional subnets. See "IP subnets" on page 6-4 for details.

The Netopia Firmware Version 5.4 supports multiple IP subnets on the Ethernet interface. You may want to configure multiple IP subnets to service more hosts than are possible with your primary subnet. It is not always possible to obtain a larger subnet from your ISP. For example, if you already have a full Class C subnet, your only option is multiple Class C subnets, since it is virtually impossible to justify a Class A or Class B assignment.

If you are using NAT, you can use the reserved Class A or Class B subnet.

- Select **Default IP Gateway** and enter the IP address for a default gateway. This can be the address of any major router accessible to the Router.

A default gateway should be able to successfully route packets when the Router doesn't know how to route to the intended recipient's IP address. Typically, a default gateway is the ISP's router.

- If a backup gateway is available, select **Backup IP Gateway** and enter the IP address of a gateway that you want to use for backup in the event of a connection failure. See [“Backup Default Gateway” on page 7-13](#) for configuration details.
  - Select **Primary Domain Name Server** and enter the IP address for a domain name server. The domain name server matches the alphabetic addresses favored by people (for example, robin.hood.com) to the IP addresses actually used by IP routers (for example, 163.7.8.202).
  - If a secondary DNS server is available, select **Secondary Domain Name Server** and enter its IP address. The secondary DNS server is used by the Router when the primary DNS server is inaccessible. Entering a secondary DNS is useful but not necessary.
  - Select **Domain Name** and enter your network's domain name (for example, netopia.com). Netopia strongly recommends that you enter a domain name.
  - Routing Information Protocol (RIP) is needed if there are IP routers on other segments of your Ethernet network that the Router needs to recognize. If this is the case select **RIP Options** and press Return. This will take you to the Ethernet LAN RIP options screen, where you can configure several parameters, including RIP v2 MD5 Authentication. See [“RIP-2 MD5 Authentication” on page 6-10](#).
    - With Receive RIP set to v1, the Ethernet port will accept routing information provided by RIP packets from other routers that use the same subnet mask. Set to v2, the router will accept routing information provided by RIP packets from other routers that use different subnet masks. Set to Both, the router will accept information from either RIP v1 or v2 routers.
    - With Transmit RIP v1 selected, the router will generate RIP packets only to other RIP v1 routers. With Transmit RIP v2 (broadcast) selected, the router will generate RIP packets to all other hosts on the network. With Transmit RIP v2 (multicast) selected, the router will generate RIP packets only to other routers capable of recognizing RIP v2 packets.
  - If you want to enable Multicast Forwarding, select **Multicast Forwarding** and from the pop-up menu, choose the type that you want to enable. See [“Multicast Forwarding” on page 6-34](#) for detailed configuration.
- If you enable Multicast Forwarding, the next field **IGMP Version** appears. You can choose v1 or v2 from the pop-up menu.
- Select **Static Routes** to manually configure IP routes. See the section [“Static routes,”](#) below.
  - If you select **IP Address Serving** you will be taken to the IP Address Serving screen (see [“IP Address Serving” on page 6-17](#)). Since no two hosts can use the same IP address at the same time, make sure

that the addresses distributed by the Router and those that are manually configured are not the same. Each method of distribution must have its own exclusive range of addresses to draw from.

### IP subnets

The IP Subnets screen allows you to configure up to eight Ethernet IP subnets on unlimited-user models, one “primary” subnet and up to seven secondary subnets, by entering IP address/subnet mask pairs:

IP Subnets		
	IP Address	Subnet Mask
#1:	192.128.117.162	255.255.255.0
#2:	0.0.0.0	0.0.0.0
#3:		
#4:		
#5:		
#6:		
#7:		
#8:		

**Note:** You need not use this screen if you have only a single Ethernet IP subnet. In that case, you can continue to enter or edit the IP address and subnet mask for the single subnet on the IP Setup screen.

This screen displays up to eight rows of two editable columns, preceded by a row number between one and eight. If you have eight subnets configured, there will be eight rows on this screen. Otherwise, there will be one more row than the number of configured subnets. The last row will have the value 0.0.0.0 in both the IP address and subnet mask fields to indicate that you can edit the values in this row to configure an additional subnet. All eight row labels are always visible, regardless of the number of subnets configured.

- To add an IP subnet, enter the Router’s IP address on the subnet in the **IP Address** field in a particular row and the subnet mask for the subnet in the **Subnet Mask** field in that row.

For example:

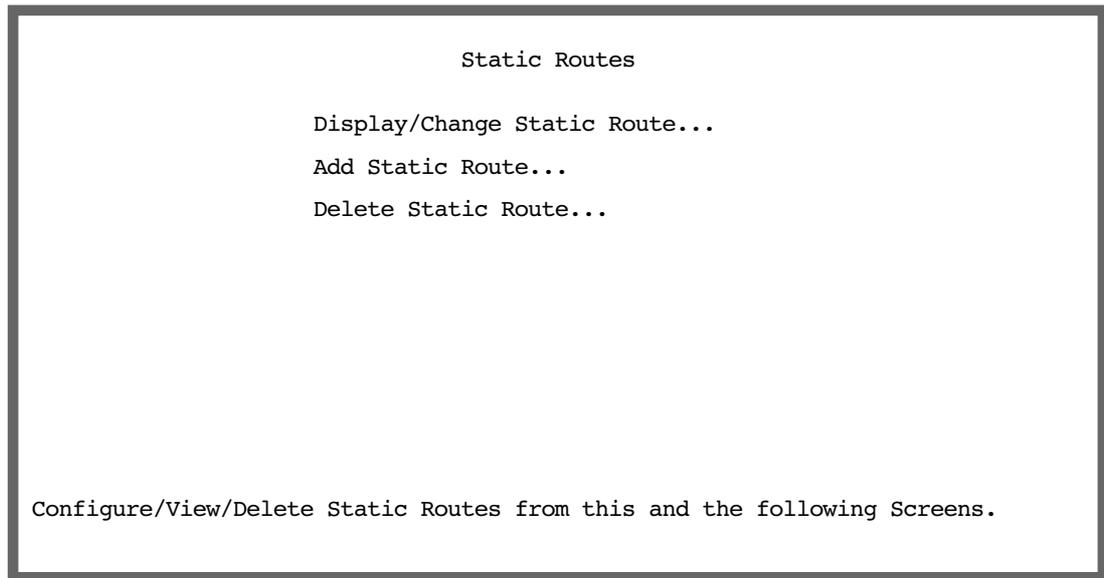
IP Subnets	
IP Address	Subnet Mask
#1: 192.128.117.162	255.255.255.0
#2: 192.128.152.162	255.255.0.0
#3: 0.0.0.0	0.0.0.0
#4:	
#5:	
#6:	
#7:	
#8:	

- To delete a configured subnet, set both the IP address and subnet mask values to 0.0.0.0, either explicitly or by clearing each field and pressing Return to commit the change. When a configured subnet is deleted, the values in subsequent rows adjust up to fill the vacant fields.

The subnets configured on this screen are tied to the address serving pools configured on the IP Address Pools screen, and that changes on this screen may affect the IP Address Pools screen. In particular, deleting a subnet configured on this screen will delete the corresponding address serving pool, if any, on the IP Address Pools screen.

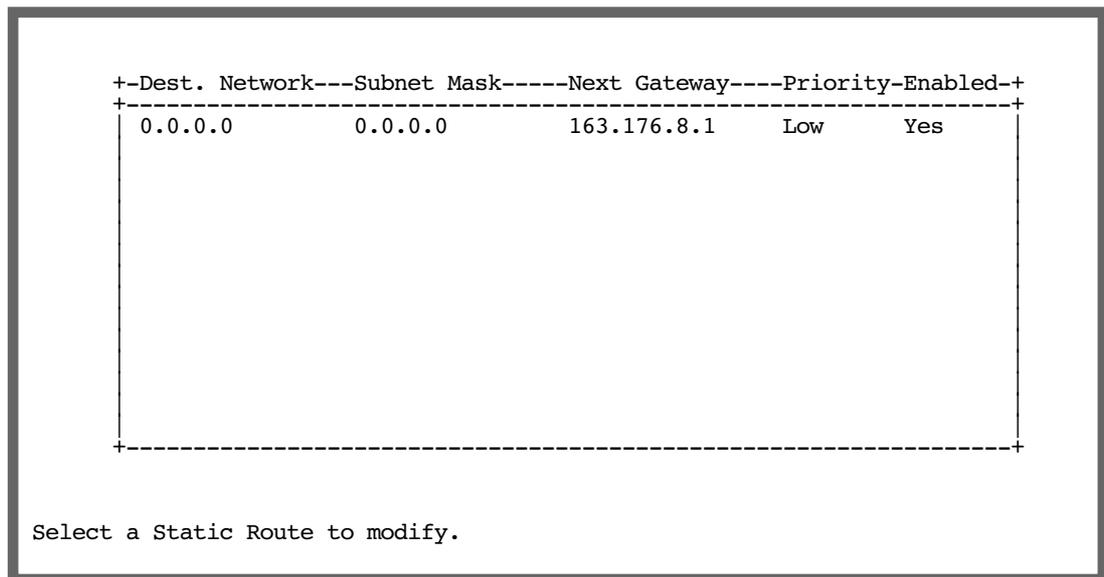


The Static Routes screen will appear.



### Viewing static routes

To display a view-only table of static routes, select **Display/Change Static Route**. The table shown below will appear.



The table has the following columns:

**Dest. Network:** The network IP address of the destination network.

**Subnet Mask:** The subnet mask associated with the destination network.

**Next Gateway:** The IP address of the router that will be used to reach the destination network.

**Priority:** An indication of whether the Router will use the static route when it conflicts with information received from RIP packets.

**Enabled:** An indication of whether the static route should be installed in the IP routing table.

To return to the Static Routes screen, press Escape.

### *Adding a static route*

To add a new static route, select **Add Static Route** in the Static Routes screen. The Add Static Route screen will appear.

Add Static Route

Static Route Enabled:	Yes
Destination Network IP Address:	0.0.0.0
Destination Network Subnet Mask:	0.0.0.0
Next Gateway IP Address:	0.0.0.0
Route Priority...	High
Advertise Route Via RIP:	No

ADD STATIC ROUTE NOW                      CANCEL

Configure a new Static Route in this Screen.

- To install the static route in the IP routing table, select **Static Route Enabled** and toggle it to **Yes**. To remove the static route from the IP routing table, select **Static Route Enabled** and toggle it to **No**.
- Be sure to read the rules on the installation of static routes in the IP routing table. See [“Rules of static route installation” on page 6-9](#).
- Select **Destination Network IP Address** and enter the network IP address of the destination network.
- Select **Destination Network Subnet Mask** and enter the subnet mask used by the destination network.
- Select **Next Gateway IP Address** and enter the IP address for the router that the Router will use to reach the destination network. This router does not necessarily have to be part of the destination network, but it must at least know where to forward packets destined for that network.
- Select **Route Priority** and choose **High** or **Low**. High means that the static route takes precedence over RIP

information; Low means that the RIP information takes precedence over the static route.

- If the static route conflicts with a connection profile, the connection profile will always take precedence.
- To make sure that the static route is known only to the Router, select **Advertise Route Via RIP** and toggle it to **No**. To allow other RIP-capable routers to know about the static route, select **Advertise Route Via RIP** and toggle it to **Yes**. When Advertise Route Via RIP is toggled to **Yes**, a new item called **RIP Metric** appears below **Advertise Route Via RIP**.

With RIP Metric you set the number of routers, from 1 to 15, between the sending router and the destination router. The maximum number of routers on a packet's route is 15. Setting **RIP Metric** to **1** means that a route can involve 15 routers, while setting it to **15** means a route can only involve one router.

- Select **ADD STATIC ROUTE NOW** to save the new static route, or select **CANCEL** to discard it and return to the Static Routes screen.
- Up to 32 static routes can be created, but one is always reserved for the default gateway, which is configured using either Easy Setup or the IP Setup screen in system configuration.

### *Modifying a static route*

To modify a static route, in the Static Routes screen select **Display/Change Static Route** to display a table of static routes.

Select a static route from the table and go to the Change Static Route screen. The parameters in this screen are the same as the ones in the Add Static Route screen (see [“Adding a static route”](#) on page 6-8).

### *Deleting a static route*

To delete a static route, in the Static Routes screen select **Delete Static Route** to display a table of static routes. Select a static route from the table and press Return to delete it. To exit the table without deleting the selected static route, press Escape.

### *Rules of static route installation*

The Netopia Firmware Version 5.4 applies certain rules before installing enabled static routes in the IP routing table. An enabled static route will not be installed in the IP routing table if any of the following conditions are true:

- The static route's **Next Gateway IP Address** matches an IP address in the range of IP addresses being distributed by DHCP.
- The static route's **Next Gateway IP Address** is determined to be unreachable by the Router.
- The static route's route information conflicts with a connection profile's route information.
- The connection profile associated with the static route has a disabled dial-on-demand setting, and there is no current connection using that connection profile.

A static route that is already installed in the IP routing table will be removed if any of the conditions listed above become true for that static route. However, an enabled static route is automatically reinstalled once the conditions listed above are no longer true for that static route.

---

## RIP-2 MD5 Authentication

Firmware version 5.3.7 supports RIP-2 MD5 Authentication (RFC2082 Routing Internet Protocol Version 2, Message Digest 5). The purpose of MD5 authentication is to provide an additional level of confidence that a RIP packet received was generated by a reliable source. In other words, MD5 authentication provides an enhanced level of security that information that your PC receives does not originate from a malicious source posing as part of your network.

### Overview

All participants in an authenticated RIP environment on a network must share an identifier key. There is no key exchange protocol like IKE, so all keys must be manually entered by an administrator.

RIP-2 MD5 Authentication requires that an interface configured to receive authenticated packets ignore unauthenticated packets or packets authenticated with an invalid key. An interface that is not configured for receiving authenticated packets ignores authenticated ones.

On a Netopia router, every interface will be allowed to have up to two keys. RIP-2 MD5 authentication can be configured on the Ethernet LAN (all models), Ethernet WAN models, Connection Profiles, and the Default Profile. Keys can have lifetimes, defined as a start date and time and an end date and time, or infinite.

### Key management

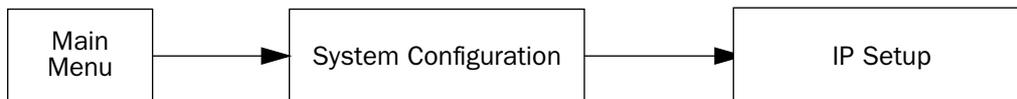
Typically, you configure only one key on a given interface and all of the interfaces that interact with that interface. RIP updates are sent every 30 seconds. Each RIP packet is authenticated using one key and sent. When the Netopia router receives an authenticated RIP packet from a device, it keeps track of that device (peer).

The longer it is in use, a single key becomes less secure. Therefore, RFC2082 specifies that an interface *must* support at least two keys per interface to allow a transition from an old key to a new key. It is recommended that you specify an overlapping time of five minutes for transitioning from one key to the next. Whenever two keys are valid at the same time, the Netopia router tries to determine if other peers (devices that it has received an authenticated packet from in the past three minutes) on its network are using the new key. If any of the peers have not used the new key yet, the Netopia router will send RIP updates twice, once with each key.

If the last valid key expires, the Device Event History logs a “\* RIP: last authentication key expired” message, and continues to use that key as if it were still valid.

### Authentication configuration

To configure RIP-2 MD5 authentication, from the Main Menu, select **System Configuration**, then **IP Setup**.



The IP Setup screen appears.

```

                                IP Setup

Ethernet IP Address:             192.168.1.1
Ethernet Subnet Mask:          255.255.255.0
Define Additional Subnets...

Default IP Gateway:            0.0.0.0
Backup IP Gateway:             0.0.0.0
Primary Domain Name Server:    0.0.0.0
Secondary Domain Name Server:  0.0.0.0
Domain Name:

RIP Options...

Multicast Forwarding...       None

Static Routes...              IP Address Serving...

```

- Select **RIP Options**. The Ethernet LAN RIP Options screen appears.

```

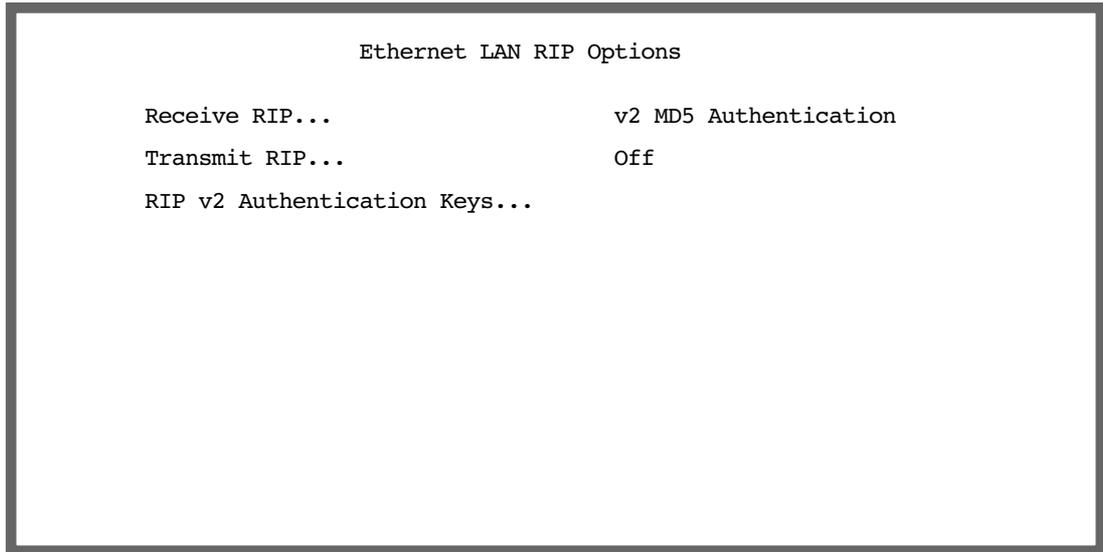
                                Ethernet LAN RIP Options

Receive RIP...                  +-----+
                                | Off       |
Transmit RIP...                 | v1      |
                                | v2      |
                                | Both v1 and v2 |
                                | v2 MD5 Authentication |
                                +-----+

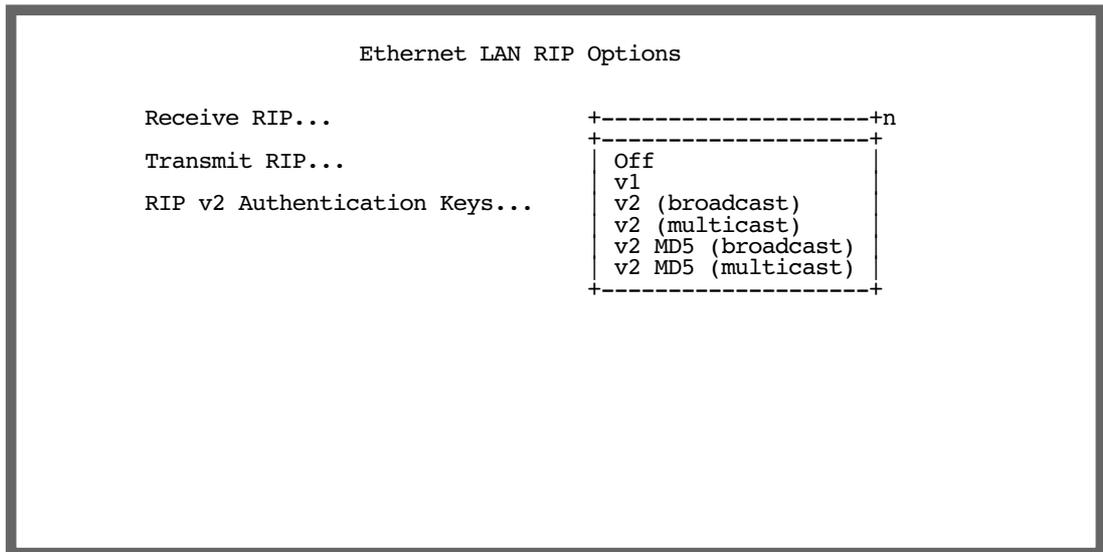
```

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- Select **Receive RIP**, and from the pull-down menu choose **v2 MD5 Authentication**.



- You can also select **Transmit RIP**, and choose **v2 MD5 (broadcast)** or **v2 MD5 (multicast)** from the pull-down menu.



- **RIP v2 Authentication Keys** is visible only if v2 MD5 Authentication is enabled for either Receive or

Transmit RIP.

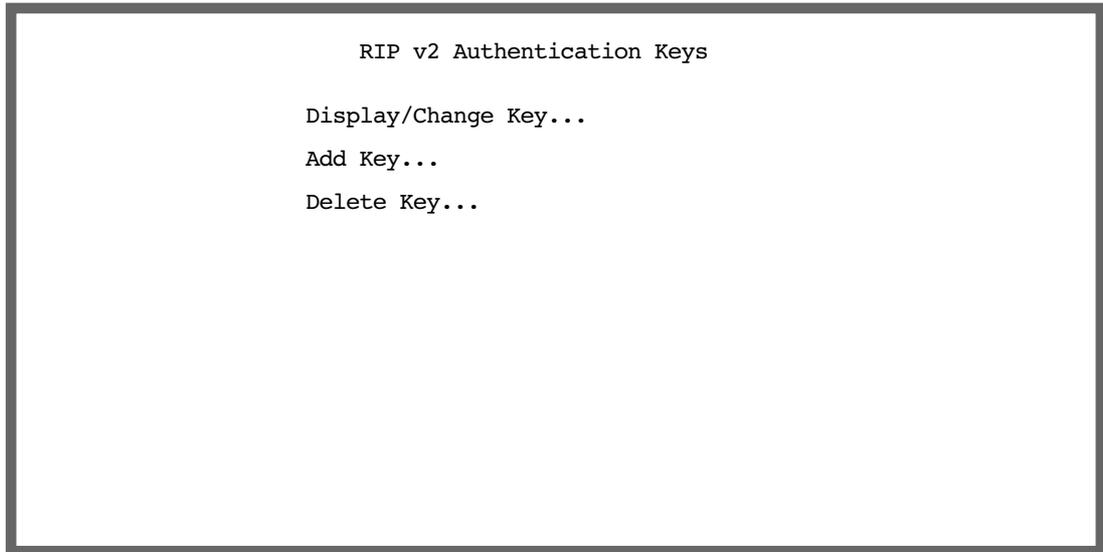
---

**Note:**

- All of the changes on this menu require a reboot. This is unique to the Ethernet LAN. RIP changes on all other interfaces are immediately effective.
- If you set the RIP Receive option to **Both v1 and v2**, the interface will ignore authenticated RIP packets since authenticated v1 packets do not exist. Only v2 packets can be authenticated.

- 
- Select **RIP v2 Authentication Keys**.

The RIP v2 Authentication Keys screen appears.



## Adding a key

Select **Add Key**. The Add Key Screen appears.

Add Key	
Key ID:	0
Authentication Key:	
Start Date (MM/DD/YY):	10/10/2002
Start Time (hh:mm):	12:00
AM or PM:	AM
End Time Mode:	Date
End Date (MM/DD/YY):	10/10/2002
End Time (hh/mm):	12:00
AM or PM:	AM
COMMIT	CANCEL

- The key identifier **Key ID** can be any numeric value from 0 – 255, and must be unique per interface. You can not have two keys with the same key ID on an interface.
  - The **Authentication Key** may consist of from 1 – 16 ASCII characters. These appear as asterisks when typed.
  - The **Start Date** and **End Date** formats are determined by the System Date Format, set on the Set Date and Time menu under the System Configuration menus.
  - The **Start Time** and **End Time** formats are determined by the System Time Format. The AM or PM pull-down menus do not appear if the time format is 24 hour time.
  - The **End Time Mode** pull-down menu allows you to select either Date or Infinite. This determines whether or not the key will expire at a specified time and date, or remain effective indefinitely.
- End Date**, **End Time**, and **AM or PM** do not appear if the End Time Mode is set to “Infinite”. Infinite means that the key begins when it begins, but it never expires. The acceptable year range is from 1904 – 2039.
- When you are satisfied with your entries, select **COMMIT** and press Return.

This menu will not accept a non-unique Key ID on the same interface; failure to enter an authentication key; or a negative start date, end date, or start time and end time range.

Changes to RIP Keys on all interfaces are immediately effective. This differs from the remainder of the RIP configuration on the Ethernet LAN, which requires a reboot. It is important that the keys be able to change dynamically, however, because the purpose of entering more than one key on an interface is to insure a smooth transition between keys with no network outages.

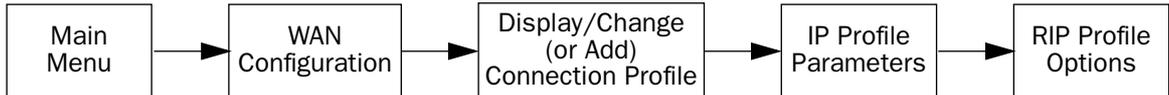


## Connection Profiles and Default Profile

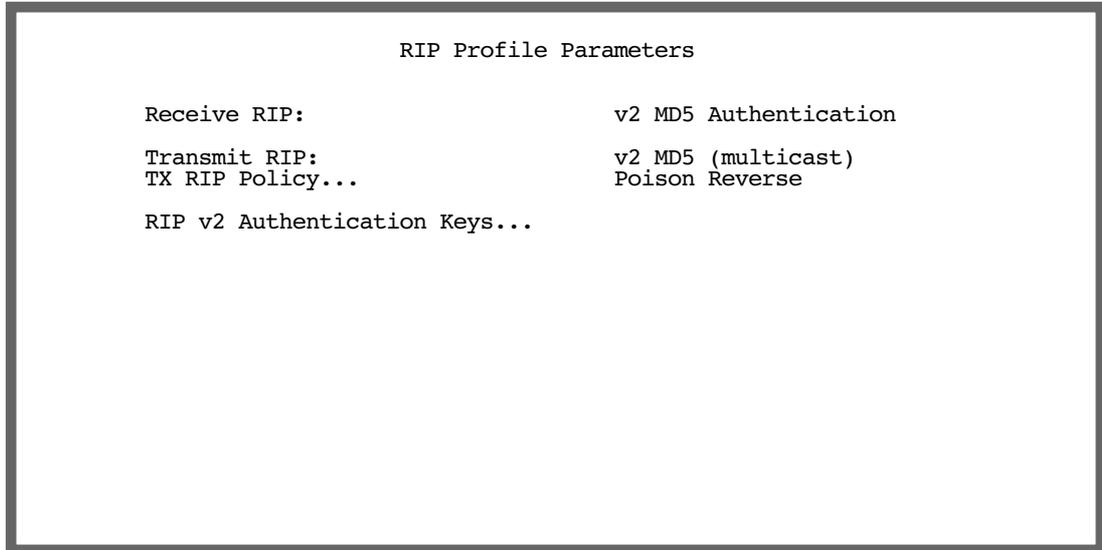
RIP-2 MD5 authentication may be configured in Connection Profiles, as well. If you are not using NAT, your public Internet connection can benefit from sending authenticated RIP packets as well as receiving them. To configure RIP-2 MD5 authentication for a Connection Profile, you can either change an existing Connection Profile, or create a new one.

The Default Profile Leased and Switched menus are the same as the Connection Profile RIP option and associated menus. For brevity, the following example shows only the Connection Profile RIP option and associated menus.

In either case, navigate to the **RIP Profile Parameters** screen under the IP Profile Parameters menu of the Display/Change (or Add) Connection Profile screen.



The connection profile RIP Profile Parameters screen appears.



- **Receive RIP** is always visible. Here you select Off, v1, v2, Both v1 and v2, or v2 MD5 Authentication from the pull-down menu. For MD5 authentication, you must select **v2 MD5 Authentication**.
- If NAT is disabled, **Transmit RIP** is visible. Here you select Off, v1, v2 (broadcast), v2 (multicast), v2 MD5 (broadcast), or v2 MD5 (multicast) from the pull-down menu. For MD5 authentication, you must select **v2 MD5** (either **broadcast** or **multicast**).
- If you chose any Transmit RIP option other than Off, **TX RIP Policy** is visible. Here you select Poison Reverse, Split Horizon, or No Split Horizon from the pull-down menu. Unless otherwise instructed, leave the default Poison Reverse.
- If either Receive RIP or Transmit RIP is set to v2 MD5 Authentication, **RIP v2 Authentication Keys** is visible. Selecting RIP v2 Authentication Keys takes you to the RIP v2 Authentication Keys screen, where you can configure your keys in the same manner as in [“Adding a key,”](#) on page 14. After configuring your key,

press **COMMIT** in the Add or Change Key screen, then press Escape three times to return to the Add or Change Connection Profile screen.

- Select **COMMIT** in the Connection Profile screen and press Return. Your changes become effective for the specified Connection Profile.

## Power interruptions

Netopia 4000 Series routers use NTP updates to set the correct time. Consequently, the starting time after a power cycle, whether from power failure or deliberately switching power off and on, is in the year 1904. This could invalidate some keys that would otherwise be valid. To prevent this, if the system time is before the year 2000, all keys are considered valid regardless of their specified date and time ranges.

---

## IP Address Serving



In addition to being a router, the Router is also an IP address server. There are three protocols it can use to distribute IP addresses.

- The first, called Dynamic Host Configuration Protocol (DHCP), is widely supported on PC networks, as well as Apple Macintosh computers using Open Transport and computers using the UNIX operating system. Addresses assigned via DHCP are “leased” or allocated for a short period of time; if a lease is not renewed, the address becomes available for use by another computer. DHCP also allows most of the IP parameters for a computer to be configured by the DHCP server, simplifying setup of each machine.
- The second, called BootP (also known as Bootstrap Protocol), is the predecessor to DHCP and allows older IP hosts to obtain most of the information that a DHCP client would obtain. However, in contrast, BootP address assignments are “permanent” since there is no lease renewal mechanism in BootP.
- The third protocol, called Dynamic WAN, is part of the PPP/MP suite of wide area protocols used for WAN connections. It allows remote terminal adapters and NAT-enabled routers to be assigned a temporary IP address for the duration of their connection.

Since no two hosts can use the same IP address at the same time, make sure that the addresses distributed by the Router and those that are manually configured are not the same. Each method of distribution must have its own exclusive range of addresses to draw from.



Consequently, the DHCP lease time is configurable. The **DHCP Lease Time (Hours)** setting allows you to modify the router's default lease time of one hour. You can enter any number up to and including 168 hours (one week) for the DHCP lease.

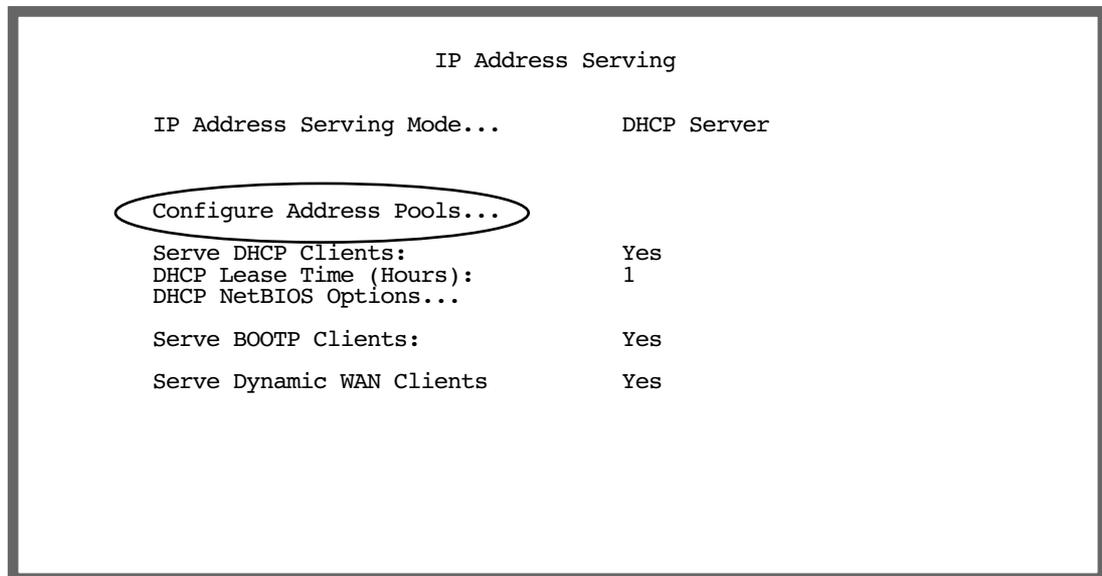
---

**Note:** About DHCP Auto-configuration:

Beginning with Firmware Version 5.3.4, routers whose model number ends in **-T** will allow the IP Address Server to auto-configure when the router is configured with a new IP Address and Subnet Mask. This applies according to the following guidelines:

- If you configure the router with a 24 bit Subnet Mask (Class C), the router will continue serving from 100-199, with the new IP Address.
  - If you configure the router with a subnet smaller than a Class C subnet, the router will serve all available addresses.
  - If you explicitly configure the DHCP pool, auto-configuration of the DHCP pool is suppressed.
  - If you configure the router manually and you would like the router to auto-configure DHCP, you must explicitly set the IP Address and Subnet Mask to 0.0.0.0 and reboot.
- 

If you have configured multiple Ethernet IP subnets, the appearance of the IP Address Serving screen is altered slightly:



Three menu items are hidden, and **Configure Address Pools...** appears instead. If you select **Configure Address Pools...** you will be taken to the IP Address Pools screen that allows you to configure an address serving pool for each of the configured Ethernet IP subnets. See [“IP Address Pools” on page 6-20](#).

## IP Address Pools

The IP Address Pools screen allows you to configure a separate IP address serving pool for each of up to eight configured Ethernet IP subnets:

IP Address Pools			
Subnet (# host addrs)	1st Client Addr	Clients	Client Gateway
192.128.117.0 (253)	192.128.117.196	16	192.128.117.162
192.129.117.0 (253)	192.129.117.110	8	192.129.117.4

This screen consists of between two and eight rows of four columns each. There are exactly as many rows as there are Ethernet IP subnets configured on the IP Subnets screen.

- The **Subnet (# host addrs)** column is non-selectable and non-editable. It indicates the network address of the Ethernet IP subnet for which an address pool is being configured and the number of host addresses available on the subnet. The network address is equal to the router's IP address on the subnet bitwise-ANDed with the subnet mask. The host address count is equal to the subnet size minus three, since one address is reserved for the network address, one for the subnet broadcast address, and one for the router's interface address on the subnet.

You can edit the remaining columns in each row.

- The **1st Client Addr** and **Clients** columns allow you to specify the base and extent of the address serving pool for a particular subnet. Entering 0.0.0.0 for the first client address or 0 for the number of clients indicates that no addresses will be served from the corresponding Ethernet IP subnet.
- The Client Gateway column allows you to specify the default gateway address that will be provided to clients served an address from the corresponding pool. The value defaults to the Router's IP address on the corresponding subnet (or the Router's default gateway, if that gateway is located on the subnet in question). You can override the value by entering any address that is part of the subnet.

DHCP, BootP, and dynamic WAN clients may receive an address from any one of the address serving pools configured on this screen.

Numerous factors influence the choice of served address. It is difficult to specify the address that will be served to a particular client in all circumstances. However, when the address server has been configured, and the clients involved have no prior address serving interactions, the Router will generally serve the first unused address from the first address pool with an available address. The Router starts from the pool on the first row and continues to the pool on the last row of this screen.

Once the address server and/or the clients have participated in address serving transactions, different rules apply:

- When requesting an address, a client will often suggest an address to be assigned, such as the one it was last served. The Router will attempt to honor this request if the address is available. The client stores this address in non-volatile storage, for example, on disk, and the specific storage method/location differs depending on the client operating system.
- When requesting an address, a client may provide a client identifier, or, if it does not, the Netopia Firmware Version 5.4 may construct a pseudo-client identifier for the client. When the client subsequently requests an address, the Router will attempt to serve the address previously associated with the pseudo-client identifier. This is normally the last address served to the client.
- Otherwise, the Netopia will select the least-recently used available address, starting from the first address in the first pool and ending with the last address in the last pool.

---

**Note:** The address serving pools on this screen are tied to the IP subnets configured on the IP Subnets screen. Changes to the IP Subnets screen may affect this screen. In particular, deleting a subnet on the IP Subnets screen will delete the corresponding address serving pool, if any, on this screen.

---

## DHCP NetBIOS Options

If your network uses NetBIOS, you can enable the Router to use DHCP to distribute NetBIOS information.

NetBIOS stands for Network Basic Input/Output System. It is a layer of software originally developed by IBM and Sytek to link a network operating system with specific hardware. NetBIOS has been adopted as an industry standard. It offers LAN applications a variety of “hooks” to carry out inter-application communications and data transfer. Essentially, NetBIOS is a way for application programs to talk to the network. To run an application that works with NetBIOS, a non-IBM network operating system or network interface card must offer a NetBIOS emulator. Many vendors either provide a version of NetBIOS to interface with their hardware or emulate its transport layer communications services in their network products. A NetBIOS emulator is a program provided by NetWare clients that allow workstations to run applications that support IBM's NetBIOS calls.

- Select **DHCP NetBIOS Options** and press Return. The DHCP NetBIOS Options screen appears.

DHCP NetBIOS Options

Serve NetBIOS Type:	Yes
NetBIOS Type...	Type B
Serve NetBIOS Scope:	No
NetBIOS Scope:	
Serve NetBIOS Name Server:	No
NetBIOS Name Server IP Addr:	0.0.0.0

Configure DHCP-served NetBIOS options here.

- To serve DHCP clients with the type of NetBIOS used on your network, select **Serve NetBIOS Type** and toggle it to **Yes**.

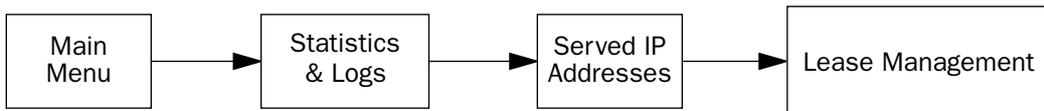
- From the **NetBIOS Type** pop-up menu, select the type of NetBIOS used on your network.

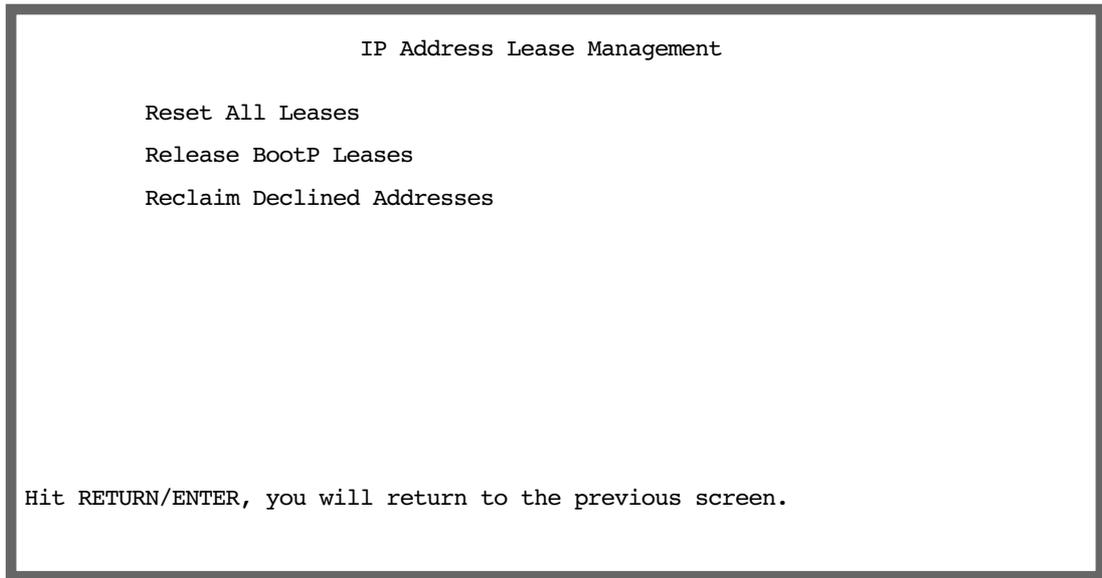
DHCP NetBIOS Options

Serve NetBIOS Type:	+-----+
NetBIOS Type...	+-----+
	Type B
	Type P
	Type M
	Type H
	+-----+
Serve NetBIOS Scope:	No
NetBIOS Scope:	0.0.0.0
Serve NetBIOS Name Server:	No
NetBIOS Name Server IP Addr:	0.0.0.0

Local network Broadcast nodes

- To serve DHCP clients with the NetBIOS scope, select **Serve NetBIOS Scope** and toggle it to **Yes**. Select **NetBIOS Scope** and enter the scope.
  - To serve DHCP clients with the IP address of a NetBIOS name server, select **Serve NetBIOS Name Server** and toggle it to **Yes**. Select **NetBIOS Name Server IP Addr** and enter the IP address for the NetBIOS name server. You are now finished setting up DHCP NetBIOS Options. To return to the IP Address Serving screen, press Escape.
  - To enable BootP's address serving capability, select **Serve BOOTP Clients** and toggle to **Yes**.
- Note:** Addresses assigned through BootP are permanently allocated from the IP Address Serving pool until you release them. To release these addresses, navigate back to the Main Menu, then Statistics & Logs, Served IP Addresses, and Lease Management.





Select **Release BootP Leases** and press Return.

- Back in IP Address Serving, the Serve Dynamic WAN Clients toggle

---

## *More Address Serving Options*

The Netopia Firmware Version 5.4 includes a number of enhancements in the built-in DHCP IP address server. These enhancements include:

- The ability to exclude one or more IP addresses from the address serving pool so the addresses will not be served to clients.
- The ability to reserve a particular IP address for a client with a particular Ethernet MAC address.
- The ability to view the host name associated with a client to which the router has leased an IP address.
- The ability for the router's Ethernet IP address(es) to overlap the DHCP address serving pool(s).
- The ability to serve as a DHCP Relay Agent.

The Netopia Firmware Version 5.4 supports reserving an IP address only for a type 1 client identifier (i.e., an Ethernet hardware address). It does not support reserving an IP address for an arbitrary client identifier. (For more information on client identifiers, see RFC 2131, section 9.14.)

## Configuring the IP Address Server options

To access the enhanced DHCP server functions, from the Main Menu navigate to **Statistics & Logs** and then **Served IP Addresses**.



The following example shows the Served IP Addresses screen after three clients have leased IP addresses. The first client did not provide a Host Name in its DHCP messages; the second and third clients did.

Served IP Addresses			
-IP Address-----	Type-----	Expires-----	Host Name/Client Identifier-----
-----SCROLL UP-----			
192.168.1.100			
192.168.1.101			
192.168.1.102			
192.168.1.103	DHCP	00:59	EN: 00-00-C5-70-00-04
192.168.1.104	DHCP	00:59	Bill's Pentium
192.168.1.105	DHCP	00:45	Steve's Power Mac
192.168.1.106			
192.168.1.107			
192.168.1.108			
192.168.1.109			
192.168.1.110			
192.168.1.111			
192.168.1.112			
192.168.1.113			
-----SCROLL DOWN-----			
Lease Management...			

The rightmost column displays the host name supplied by the client if one was provided; otherwise it displays the client identifier. (If a host name is displayed, the client identifier is still accessible in a Details pop-up menu. See below.)

**Note:** The server does not query the client for its host name. Macintosh computers running versions of MacOS prior to MacOS version 8.5 (OT 2.0.1, TCP/IP 2.0.1) do not supply a host name option in their DHCP messages, so no host name will appear in the Served IP Addresses list.

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You can select the entries in the Served IP Addresses screen. Use the up and down arrow keys to move the selection to one of the entries in the list of served IP addresses.

```

                                Served IP Addresses
-----IP Address-----Type----Expires--Host Name/Client Identifier-----
-----SCROLL UP-----
192.168.1.100
192.168.1.101
192.168.1.102
192.168.1.103
192.168.1.104
192.168.1.105
192.168.1.106      +-----+
192.168.1.107      +-----+
192.168.1.108      | Details...   | Barr's XPi 120
192.168.1.109      | Exclude      |
192.168.1.110      | Release      |
192.168.1.111      | Reserve...   |
192.168.1.112      +-----+
192.168.1.113
-----SCROLL DOWN-----
Lease Management...
```

Once you select an entry, pressing Return displays an action pop-up menu that lists operations that can be performed on that entry. Possible operations are **Details...**, **Exclude**, **Include**, **Release**, and **Reserve...** The action popup is context-sensitive and lists only those operations that apply to the selected IP address in its current lease state.

- **Details...** is displayed if the entry is associated with both a host name and a client identifier.

Selecting **Details...** displays a pop-up menu that provides additional information associated with the IP address. The pop-up menu includes the IP address as well as the host name and client identifier supplied by the client to which the address is leased.

```

Served IP Addresses
-----Type-----Expires---Host Name/Client Identifier-----
192.168.1.100
192.168.1.101
+-----+
|
| IP Address is 192.168.1.108
| Host Name is  Barr's XPi 120
| Client ID is  EN: 00-00-c5-45-89-ef
|
|                                     OK
|
+-----+
192.168.1.111   | Reserve... |
192.168.1.112   +-----+
192.168.1.113
-----SCROLL DOWN-----
Lease Management...

```

- **Exclude** is displayed if the entry is not already excluded.

Selecting **Exclude** excludes the IP address from the address serving pool so the address will not be served to a client. If the IP address is currently leased to or reserved for a client, you will be presented with a warning dialog asking you to confirm the operation.

```

Served IP Addresses
-----IP Address-----Type-----Expires---Host Name/Client Identifier-----
-----SCROLL UP-----
192.168.1.100
192.168.1.101
192.1+-----+
192.1+-----+
192.1
192.1 You are about to make changes that will affect an address
192.1 that is currently in use. Are you sure you want to do this?
192.1
192.1 CANCEL OK
192.1
192.1+-----+
192.168.1.111 | Reserve... |
192.168.1.112 +-----+
192.168.1.113
-----SCROLL DOWN-----
Lease Management...

```

- **Include** is displayed if the entry is either excluded or declined.

An IP address is marked declined when a client to whom the DHCP server offers the address declines the address. A client declines an address if it determines that a leased address is already in use by another device.

Selecting **Include** restores the selected IP address to the address serving pool so that the IP address is once again eligible to be served to a client.

- **Release** is displayed if the entry is currently offered, leased, or reserved.

Selecting **Release** puts the selected entry in the available state. You will be presented with a warning dialog asking you to confirm the operation since the IP address is in use. There is no mechanism to notify the client to whom the address is leased that the lease has been terminated. Thus, the client will continue to use the address until the next time it attempts to renew its lease. In the interim, the server may lease the same IP address to a different client, thereby creating an address conflict. For this reason, releasing an address that is actively being used by a client is generally not recommended.

- **Reserve...** is displayed if the entry is available, declined, excluded, leased, offered, or reserved.

Reserving an IP address for a client with a particular Ethernet MAC address guarantees that a client with the specified MAC address will be offered or leased the specified IP address. Moreover, it prevents the specified IP address from being offered or leased to any other client.

Selecting **Reserve...** displays a pop-up dialog box that displays the IP address and editable item in which you can enter an Ethernet MAC address. The pop-up dialog box includes **OK** and **CANCEL** buttons for confirming or cancelling the operation. If the IP address is currently offered or leased to, or reserved for, a client, you will be presented with a warning dialog asking you to confirm the operation. Reserving an IP address guarantees that the IP address will only be leased.

```

Served IP Addresses
-----
-IP Address-----Type----Expires--Host Name/Client Identifier-----
-----SCROLL UP-----
192.168.1.100
192.168.1.101
192.168.1.102
192.168.1.103
192.168.1.104
192.168.1.105
192.168.1.106
192.168.1.107
192.168.1.108
192.168.1.109
192.168.1.110
192.168.1.111
192.168.1.112
192.168.1.113
-----SCROLL DOWN-----
Lease Management...

```

```

+-----+
+-----+
IP Address is 192.168.1.108
MAC Address: 00-00-c5-45-89-ef
      CANCEL      OK
+-----+
+-----+

```

The router's Ethernet IP address(es) will be automatically excluded from the address serving pool(s) on startup. Entries in the served IP address list corresponding to the router's Ethernet IP address(es) that have been automatically excluded on startup are not selectable.

```

Served IP Addresses
-----
-IP Address-----Type----Expires--Host Name/Client Identifier-----
-----SCROLL UP-----
192.168.1.1      Excluded for the router's IP address
192.168.1.2      Excluded
192.168.1.3      DHCP      00:24      Barr's XPi 120
192.168.1.4
192.168.1.5
192.168.1.6
192.168.1.7
192.168.1.8
192.168.1.9
192.168.1.10
192.168.1.11
192.168.1.12
192.168.1.13
192.168.1.14
-----SCROLL DOWN-----
Lease Management...

Hit RETURN/ENTER for available operations.

```

---

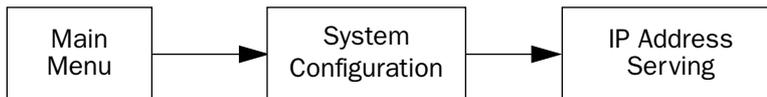
## DHCP Relay Agent

The Netopia Firmware Version 5.4 offers DHCP Relay Agent functionality, as defined in RFC1542. A DHCP relay agent is a computer system or a router that is configured to forward DHCP requests from clients on the LAN to a remote DHCP server, and to pass the replies back to the requesting client systems.

When a DHCP client starts up, it has no IP address, nor does it know the IP address of a DHCP server. Therefore, it uses an IP broadcast to communicate with one or more DHCP servers. These broadcasts are normally limited to the network segment on which the client is located, and do not pass through routers such as the Netopia Router. If the Netopia Router is configured to act as a DHCP server, it will assign the client an address from an address pool configured locally in the Netopia Router and respond to the client's request itself.

However, if the Netopia Router is configured to act as a DHCP relay agent, it does not satisfy the DHCP request itself, but instead forwards the request to one or more remote DHCP servers. These servers process the request, assign an address from an address pool configured on the remote server, and forward the response back to the Netopia Router for delivery back to the client. The agent then sends the response to the client on behalf of the DHCP server. This process is transparent to the client, which doesn't know that it is communicating through an intermediary rather than directly to a local server. Using DHCP relay, it is possible to centralize the configuration information for the host computers at many remote sites at a single location, easing the burden of administering configuration management for remote sites.

To configure the Netopia Router to act as a DHCP relay agent, from the Main Menu navigate to the System Configuration menu.



Select **IP Address Serving** and press Return. The IP Address Serving screen appears.

```

                                IP Address Serving
                                +-----+
                                |         |
IP Address Serving Mode...    | Disabled |
                                | DHCP Server |
Number of Client IP Addresses: | DHCP Relay Agent |
1st Client Address:           |         |
Client Default Gateway...     | 192.168.1.1 |
                                +-----+

Serve DHCP Clients:           Yes
DHCP NetBIOS Options...

Serve BOOTP Clients:         Yes
  
```

Select **IP Address Serving Mode**. The pop-up menu offers the choices of **Disabled**, **DHCP Server** (the default), and **DHCP Relay Agent**.

If you select DHCP Relay Agent and press Return, the screen changes as shown below.

```

                                IP Address Serving

IP Address Serving Mode...    DHCP Relay Agent

Relay Server #1:             10.1.1.1
Relay Server #2:             20.1.1.1
Relay Server #3:             30.1.1.1

Configure Address Serving (DHCP, BOOTP, etc.) here.
  
```

Now you can enter the IP address(es) of your remote DHCP server(s), such as might be located in your company's corporate headquarters. Each time you enter an IP address and press Return, an additional field appears. You can enter up to four DHCP server addresses.

In the example above, DHCP requests from clients on the LAN will be relayed to the DHCP servers at IP addresses 10.1.1.1, 20.1.1.1, and 30.1.1.1.

**Note:** The remote DHCP server(s) to which the Netopia Router is relaying DHCP requests must be capable of servicing relayed requests. Not all DHCP servers support this feature. For example, the DHCP server in the Netopia Router does *not*.

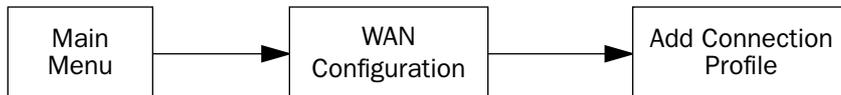
The DHCP server(s) to which the Netopia Router is relaying DHCP requests must be configured with one or more address pools that are within the Netopia Router's primary Ethernet LAN subnet. (There is no mechanism for DHCP clients to receive an address on a secondary subnet via a relayed DHCP request.)

---

## Connection Profiles

Since you will probably only have a single connection to your ISP over the remote link, you may not need to create multiple connection profiles. Additional profiles may be useful for creating VPNs.

Connection Profiles define the line and networking protocols necessary for the router to make a remote connection. A connection profile is like an address book entry describing how the router is to get to a remote site, or how to recognize and authenticate a remote user connecting to the router. To create a new Connection Profile, you navigate to the WAN Configuration screen from the Main Menu, and select **Add Connection Profile**.



The Add Connection Profile screen appears.

```

                                Add Connection Profile

Profile Name:                               Profile 1
Profile Enabled:                            Yes
Data Link Encapsulation...                  PPP
Data Link Options...

IP Profile Parameters...

COMMIT                                     CANCEL

Configure a new Conn. Profile. Finished? COMMIT or CANCEL to exit.
  
```

On a Router you can add up to 15 more connection profiles, for a total of 16, although only one can be used at a time, unless you are using VPNs.

1. Select **Profile Name** and enter a name for this connection profile. It can be any name you wish. For example: the name of your ISP.
2. Toggle the **Profile Enabled** value to **Yes** or **No**. The default is Yes.
3. Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

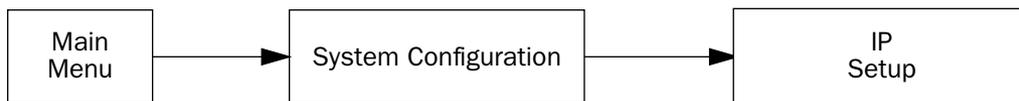
IP Profile Parameters

Address Translation Enabled:	Yes
IP Addressing...	Numbered
NAT Map List...	Easy-PAT List
NAT Server List...	Easy-Servers
Local WAN IP Address:	0.0.0.0
Local WAN IP Mask:	0.0.0.0
Remote IP Address:	0.0.0.0
Remote IP Mask:	0.0.0.0
Filter Set...	
Remove Filter Set	
RIP Profile Options...	

Configure IP requirements for a remote network connection here.

4. Toggle or enter any IP parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information on NAT, see [“Multiple Network Address Translation,” beginning on page 3-1.](#)  
The Local WAN IP Address is displayed for numbered or NAT profiles. The Local WAN IP Mask is displayed for numbered profiles. The Remote IP Address and Remote IP Mask are displayed for unnumbered profiles.





By default, Multicast Forwarding is tuned off (None). You enable the router to transmit multicast data by selecting **Tx.** from the pull-down menu.

IP Setup

Ethernet IP Address: 192.168.1.1  
 Ethernet Subnet Mask: 255.255.255.0  
 Define Additional Subnets...

Default IP Gateway: 0.0.0.0  
 Backup IP Gateway: 0.0.0.0  
 Primary Domain Name Server: 0.0.0.0  
 Secondary Domain Name Server: 0.0.0.0  
 Domain Name:

Receive RIP... Both  
 Transmit RIP... +-----+  
 Multicast Forwarding... +-----+  
 IGMP Version... | None |  
 | Tx. |  
 +-----+

Static Routes... IP Address Serving...

If you enable Multicast Forwarding, you will see a new option **IGMP Version**. This lets you choose V1 or V2. If you know you will be communicating with other hosts that are limited to V1, select V1; otherwise, allow the default V2.

Navigate to the **IP Profile Parameters** screen.



IP Profile Parameters	
Address Translation Enabled:	Yes
IP Addressing...	Numbered
NAT Map List...	Easy-PAT List
NAT Server List...	Easy-Servers
Local WAN IP Address:	0.0.0.0
Local WAN IP Mask:	0.0.0.0
Remote IP Address:	0.0.0.0
Remote IP Mask:	0.0.0.0
Filter Set...	+-----+
Remove Filter Set	+-----+
	None
	Rx.
	+-----+
Multicast Forwarding...	
RIP Profile Options...	

Typically, you will have a Connection Profile that you created in Easy Setup. You may have more. Select the Connection Profile that you want to use from the **Display/Change Connection Profile** menu, and then select **IP Profile Parameters**.

By default, Multicast Forwarding is turned off (None) on Connection Profiles until you enable a specific Connection Profile to receive multicast data. You enable it by selecting **Rx.** from the pull-down menu.

# Chapter 7

## Line Backup

The firmware offers line backup functionality in the event of a line failure on a DSL, Ethernet, or leased-line primary WAN link. The firmware supports backup

- to an external modem connected to the Console port or
- to a backup default gateway.

Configuration of either method is similar, but differences are noted in their respective sections.

This chapter covers the following topics:

- [“External Dial Backup Support” on page 7-2](#)
- [“Configuring External Dial Backup” on page 7-2](#)
- [“WAN Configuration” on page 7-2](#)
- [“Connection Profiles” on page 7-7](#)
- [“Using Scheduled Connections with Backup” on page 7-8](#)
- [“Management/Statistics” on page 7-10](#)
- [“QuickView” on page 7-12](#)
- [“Event Logs” on page 7-12](#)
- [“SNMP Support” on page 7-13](#)
- [“Backup Default Gateway” on page 7-13](#)

The purpose of backup is to provide a recovery mechanism in the event that the primary connection fails. A failure can be either line loss, for example by central site switch failure or physical cable breakage, or in the case of Frame Relay (with LMI) or PPP, loss of end-to-end connectivity. Detection of one of these failures causes the router to switch from using the primary WAN port to using the Console port to which a modem has been attached. Alternatively, you can choose backup to an alternate gateway on the Ethernet LAN.

In the event of a loss of primary connectivity you have the option of switching back to the primary port automatically once it has recovered its connection.

---

## External Dial Backup Support

Netopia equipment that supports the external dial backup feature automatically display the serial port configuration menus described in the following sections.

Models that do not support external dial backup do not display external dial backup-related menus, but offer menus for backup to a default gateway. Generally, models that support external dial backup can be determined from the following matrix:

External Dial Backup – Supported Models Matrix				
WAN Interface:	T1	SDSL	SHDSL	ADSL
IADs:	Yes	Yes	Yes	*
Data Routers:	Yes	Yes	Yes	*
* ADSL models do not currently support dial backup, but will support it in a revision in the near future.				

---

## Configuring External Dial Backup

Four menus support external dial backup configuration:

- the **Serial Port Configuration** menu under the **WAN Configuration** menus  
Here you select the **Modem/Auto** mode to allow the Console port to be used for a modem.
- the **Backup Configuration** menu under **WAN Configuration, Advanced Connection Options**  
Here you select **Backup is... Automatic**, and **Recovery** is **Automatic**.
- the **Add Connection Profile** menus under the **WAN Configuration** menus  
Here you choose **Encapsulation Type = PPP**, fill out the correct IP information, select **Backup** as the interface group, and fill out the **Telco Options**.
- the **Backup IP Gateway** menu item in the **IP Setup** screen under the **System Configuration** menu  
Here you enter the Backup Gateway IP address.

Detailed descriptions follow.

---

## WAN Configuration

To configure Line Backup, from the Main Menu select **WAN Configuration** and then **WAN Setup**.



```
WAN Configuration
WAN (Wide Area Network) Setup...
Display/Change Connection Profile...
Add Connection Profile...
Delete Connection Profile...

WAN Default Profile...
ATMP/PPTP Default Profile...
IKE Phase 1 Configuration...
Scheduled Connections...

Backup Configuration...

Frame Relay Configuration...
Frame Relay DLCI Configuration...

Establish WAN Connection...
Disconnect WAN Connection...

Return/Enter to create a new Connection Profile.
From here you will configure yours and the remote sites' WAN information.
```

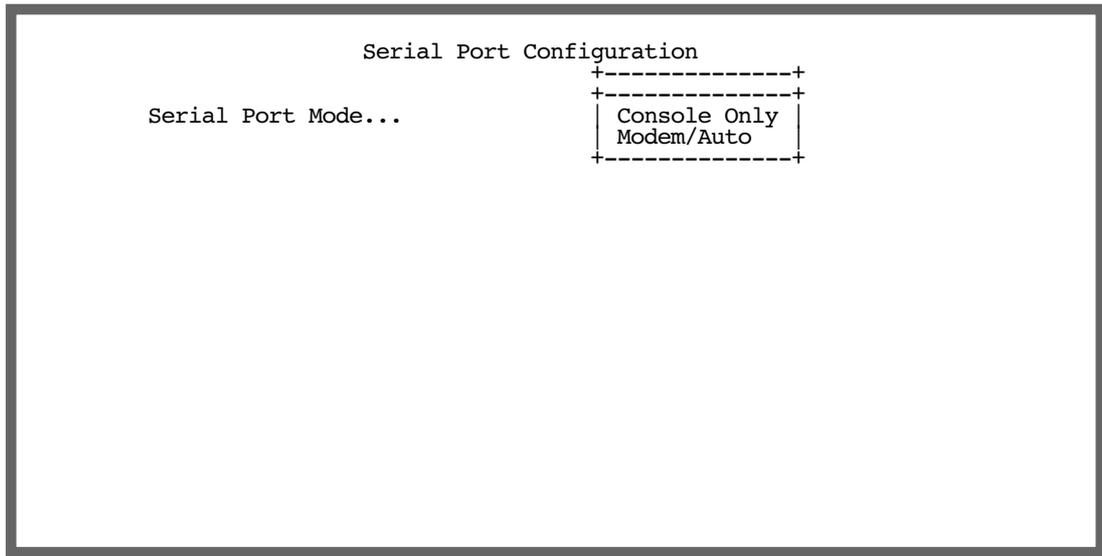
The **Choose Interface to Configure** screen appears.

```
Choose Interface to Configure

G.SHDSL-ATM Setup...
Serial Port Setup...
```

Choose the interface to configure for backup, **Serial Port Setup**.

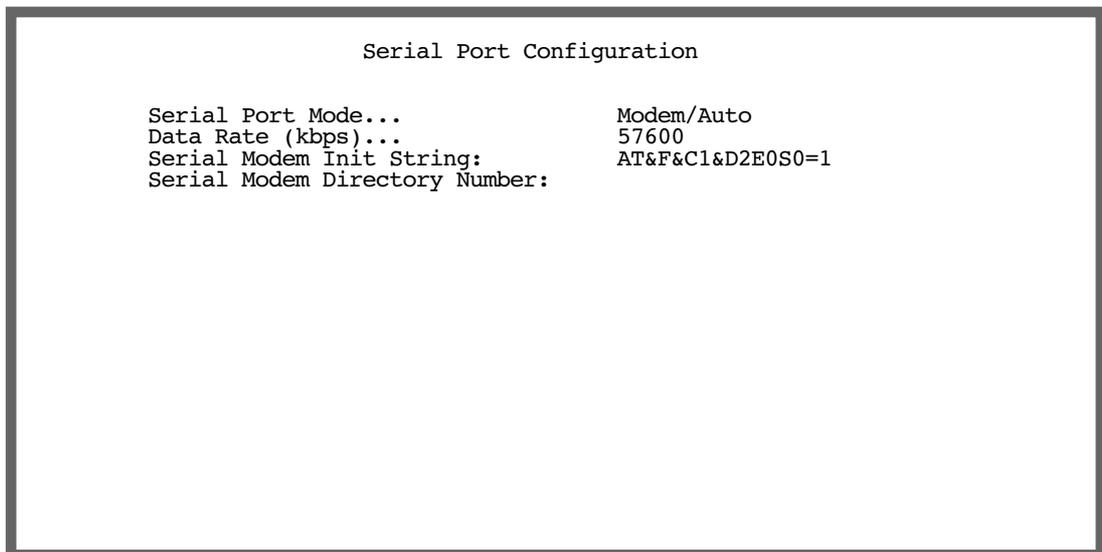
The Serial Port Configuration screen appears.



- The default mode is **Console Only**. This is the normal state for using a terminal emulation application to manage the router. See [“Connecting a Console Cable to your Equipment” on page 1-5](#).

If you select **Modem/Auto** from the pull-down menu, the router becomes capable of auto detecting the presence of a modem or a console connection attached to the serial console port.

- A console connection is detected at the connection speed defined on the Console Configuration menu (see [“Console Configuration” on page 2-43](#)).
- A modem will be detected at the data rate you specify in the following menu. It will not auto detect the Console baud rate in Modem/Auto mode.



**Note:**

- The modem cable should have a standard DB-9 female connector to connect to the console port. This is the standard type of modem cable connector.
- Macintosh users who use a USB-to-serial adapter to connect to the console serial port can use a modem in Modem/Auto mode. However, your terminal emulator software will not function in this mode via the USB adapter, due to the pin assignments in the adapter. For console management access, Macintosh users should use Console Only mode.

- If you select **Modem/Auto**, you can select its **Data Rate** from a pop-up menu, edit the **Serial Modem Init String**, if necessary, and enter your local **Serial Modem Directory Number**.

Changes to Serial Port Mode take place after a reboot. This is *not* automatic. You may continue to configure these settings, and after you are finished, you must reboot the router manually. See “[Restarting the System](#)” on page 11-12.

- Press **Escape** *twice* to return to the **WAN Configuration** screen, and select **Advanced Connection Options**, then **Backup Configuration** (shown on [page 7-5](#)).

## Backup Configuration screen

This screen is used to configure the conditions under which backup will occur, if it will recover, and how the Console port is configured.

For a modem connected to the Console port, the Backup Configuration screen appears as follows:

```

                                Backup Configuration

Backup Parameters
Backup is...                      Automatic
Requires Failure of (minutes):    1
Ping Host Name or IP Address:

Recovery to ADSL...              Automatic
Requires Recovery of (minutes):   1
Auto-Recovery on loss of Layer 2: Yes
Layer 2 Failure Timer (seconds):  0

Clear Backup Call only if idle:   Yes
Requires idle time of (seconds):  300

Data Link Encapsulation is       Async PPP

Enter Information supplied to you by your telephone company.
```

- Select **Backup is** and from the pop-up menu, select Automatic (default), Manual, or Disabled. You enable line backup by selecting either Manual or Automatic.
- Select **Requires Data Link Failure of...** and enter the number of minutes that the system should wait before it assumes that a connection failure has occurred. After that period, the system would switch to

backup mode and connect via your modem.

---

**Note:** Backup and Recovery have resolutions of five seconds. This is how often the router evaluates the state of the connections and makes decisions.

---

- Select **Ping Host Name or IP Address** and enter an IP address or resolvable DNS name that the router will ping. This is an optional item that is particularly useful for testing if the remote end of a VPN connection has gone down. Should this address become unreachable the router will treat this as a loss of connectivity and begin the backup timer. This loss is a Layer 2 loss.
- Select **Recovery to “WAN\_name”** (where *WAN\_name* is the type of WAN connection you have, e.g., ADSL) and press Return. Choose either Manual or Automatic to determine how the system will return to the primary WAN link when it becomes available again. If you choose Automatic, the next two menu items become visible.

**Note:** Automatic recovery only works upon loss of primary WAN connectivity.

- If you chose Automatic Recovery, select **Requires Recovery of...** and press Return. A pop-up menu allows you to choose among 30 Sec(onds), 1 Min(ute), 2 Min(utes), 5 Min(utes), 10 Min(utes), or 15 Min(utes). This allows you to be sure that the primary WAN connection is well re-established before the router switches back to it from the backup mode.
- You can toggle **Auto-Recovery on loss of Layer 2** to Yes or No (the default). This setting determines whether the router should try to Auto-Recover when the backup is invoked because of a Layer 2 loss, for example, a no valid Connection Profile. (Layer 1 is still available, and this is what recovery checks.) Use this setting with caution. Setting it to Yes may induce alternating switching between Backup and Recovery Mode. This field will determine the recovery behavior of a Manual backup and Ping failure backup. These two failures are treated as Layer 2 failure.
- Select **Clear Backup Call only if idle**. The default Yes will prevent the backup call from being torn down if there is activity on the backup connection when the primary connection comes back up. You can toggle this to No if you wish.
- **Requires idle time of (seconds)** specifies how long the device should wait before permitting the call to be torn down after a period of inactivity.
- **Data Link Encapsulation** is set to Async PPP. This field is not editable.

## Connection Profiles

The line backup feature allows you to configure a complete Connection Profile for the backup port, just as you do for your primary WAN connection. In this way profiles are associated with a particular interface. The profile should reflect the port it is associated with. It should have switched characteristics for the backup port.

```

                                Add Connection Profile

Profile Name:                    Profile 1
Profile Enabled:                 Yes

Data Link Encapsulation...      PPTP
Data Link Options...

IP Enabled:                      Yes
IP Profile Parameters...

                                +-----+
                                |         |
Interface Group...              | Primary |
Telco Options...                | Backup  |
                                | Any Port|
                                +-----+

COMMIT                            CANCEL

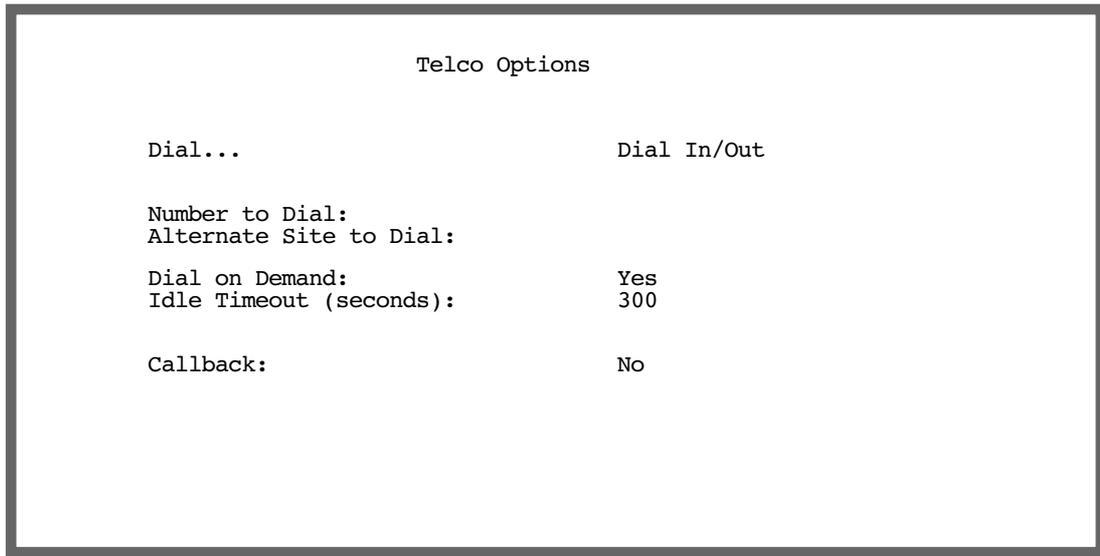
Return/Enter to discard changes you have made. Profile will not be added.
Configure a new Conn. Profile. Finished? ADD or CANCEL to exit.

```

For instructions on creating a Connection Profile see [“Creating a New Connection Profile”](#) on page 2-24.

To associate this Connection Profile with your backup port interface, choose **Backup** from the Interface Port pop-up menu and press Return.

If you choose Backup, **Telco Options** becomes visible. The Telco Options screen allows you to set the parameters for the modem connection.



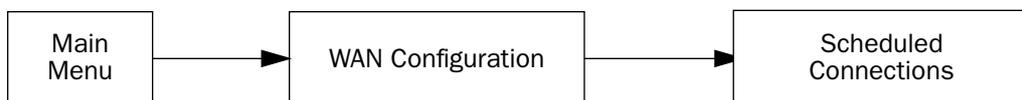
- From the **Dial** pop-up menu, you can choose whether to Dial Out Only, Dial In Only, or Dial In/Out (default).
- You can add the **Number to Dial** and an **Alternate Site to Dial**, if available.
- You can toggle **Dial on Demand** to Yes or No. This allows the router to determine whether or not to dial the backup number when there is traffic that needs to be transmitted or received.
- You can set the **Idle Timeout (seconds)** to tear down the connection after some specified period of inactivity.
- You can also toggle **Callback** to No or Yes. In most cases, since this is a backup connection, you can leave this set to the default No.

---

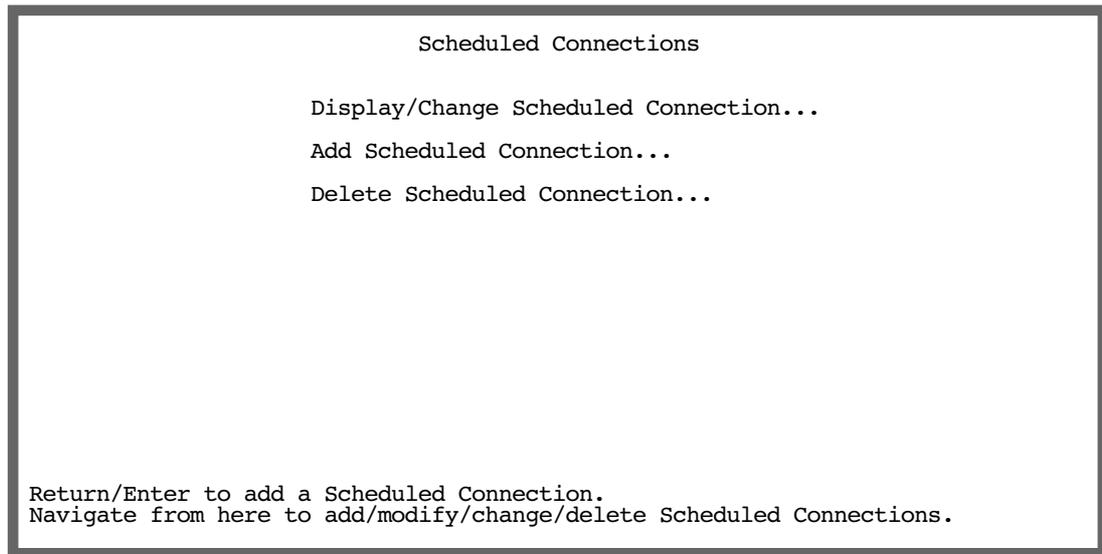
## Using Scheduled Connections with Backup

The backup link is a PPP dial-up connection and only connects to the Internet service provider when traffic is initiated from the LAN. If you want to use the backup link to provide redundancy for services, such as a Web service that you provide to the outside world, you must force the connection to stay up. You do this by creating a scheduled connection entry that will be a permanent “forced up” connection for the backup port. The backup port will be activated upon primary WAN link failure and remain active until primary WAN link recovery.

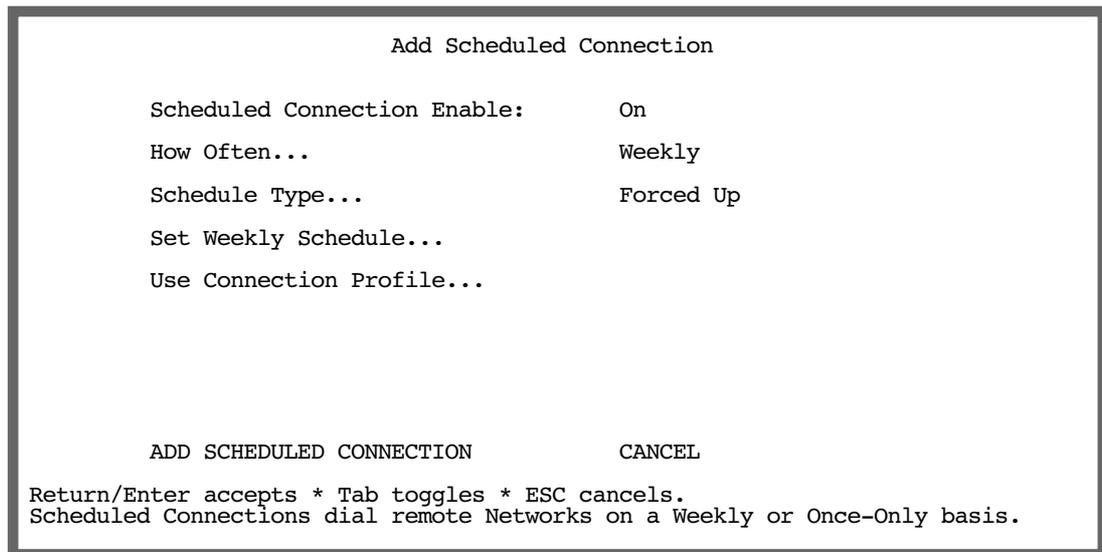
To configure a Scheduled Connection, from the Main Menu select WAN Configuration and then Scheduled Connections.



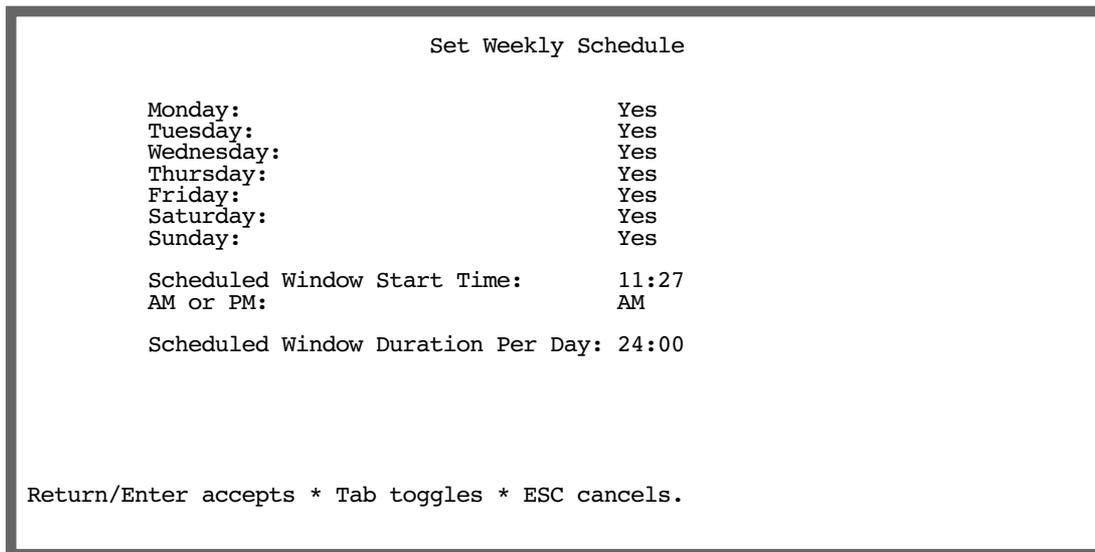
The Scheduled Connections screen appears.



- Select **Add Scheduled Connection** and press Return. The Add Scheduled Connection screen appears.



- Toggle **Scheduled Connection Enable** to **On**.
- From the **How Often** pop-up menu, select **Weekly** and press Return.
- From the **Schedule Type** pop-up menu, accept the default **Forced Up** and press Return.
- Select **Set Weekly Schedule**, and press Return. The Set Weekly Schedule screen appears.



- Toggle all the days of the week to **Yes**, and set the **Scheduled Window Duration Per Day** to **24:00**. This guarantees a 24X7 connection. Press Escape to return to the Add Scheduled Connection screen.
- Select **Use Connection Profile**, and press Return. A screen displays all of your Connection Profiles. Select the one you want to apply this scheduled connection to and press Return. Your selection becomes effective.

Now, if your primary WAN link fails, the backup link will become active and remain active until the primary link recovers.

For more information about Scheduled Connections, see [“Scheduled Connections” on page 2-29](#).

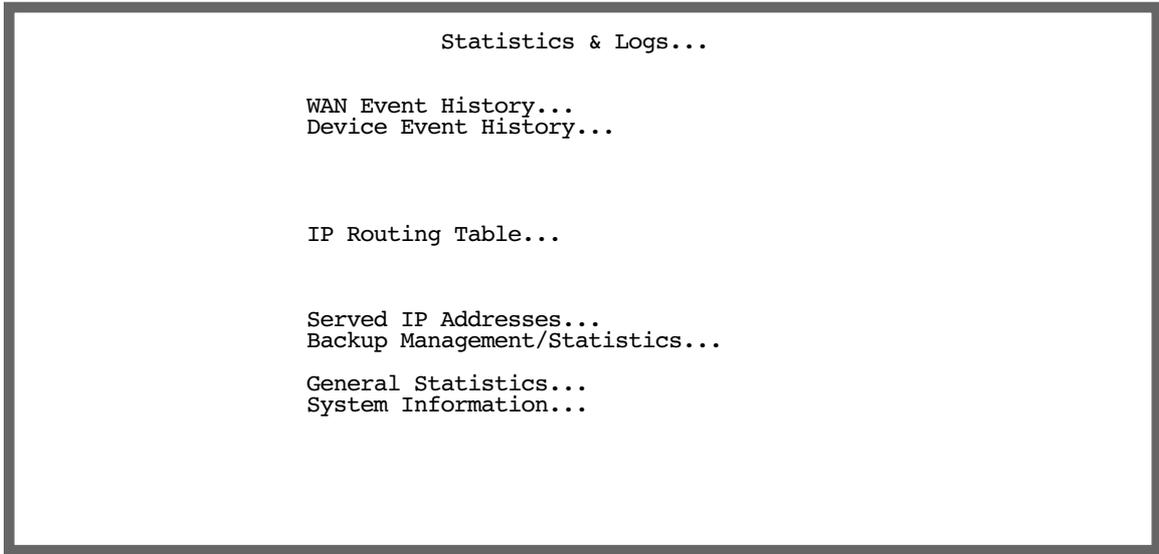
---

## Management/Statistics

The Statistics & Logs menu offers a Backup Management/Statistics option.

To view the Backup Management/Statistics, from the Main Menu select Statistics & Logs.

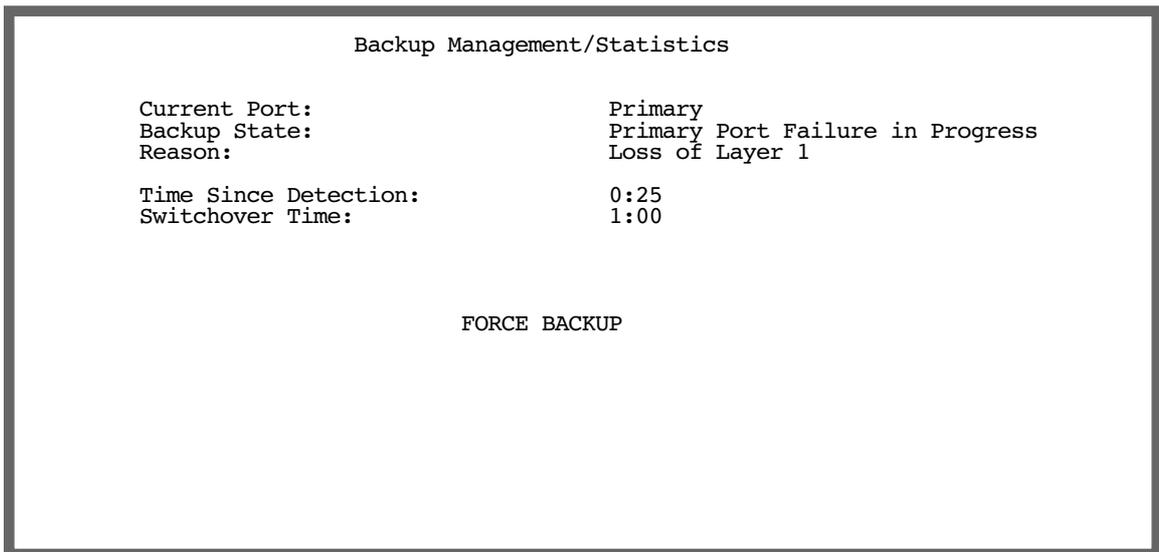




Select **Backup Management/Statistics** and press Return.

**Note:** This option is only visible if backup is not Disabled.

The Backup Management/Statistics screen appears.



- **Current Port** is a display-only field that shows which port is currently in operation.
- **Backup State** is a display-only field that shows the current state of Backup or Recovery.
- **Reason** is a display-only field that shows the cause for the current state of Backup or Recovery.
- **Time Since Detection** is a display-only field that is only visible if backup or recovery is in progress. It displays the elapsed time since detection of either primary WAN line failure or re-establishment of the

connection.

- **Switchover Time** is a display-only field that is only visible if backup or recovery is in progress. It displays the time until either automatic Backup or Recovery.
- The **FORCE BACKUP/FORCE RECOVERY** option is a selectable option that, depending on the current state of backup, will force the switching of ports. If you are currently in backup mode, the option will be **FORCE RECOVERY**. If you are currently in normal WAN link mode, the option will be **FORCE BACKUP**. Selecting either one and pressing Return will force the link to switch to the other mode.

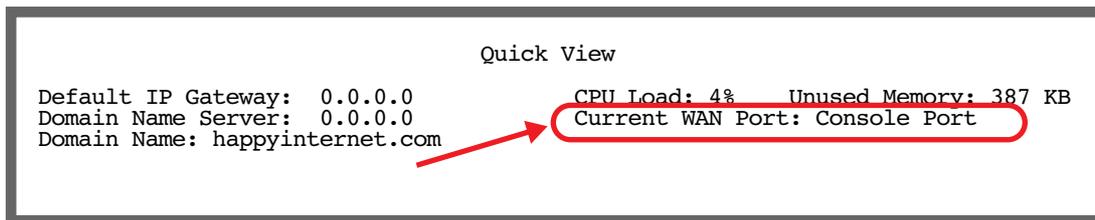
---

## QuickView

QuickView now has an information element to indicate which port is in use.

```

                                Quick View
Default IP Gateway: 0.0.0.0      CPU Load: 4%      Unused Memory: 387 KB
Domain Name Server: 0.0.0.0    Current WAN Port: Console Port
Domain Name: happyinternet.com
  
```




---

## Event Logs

When a backup or recovery occurs an event is logged in the WAN Event History.

```

                                WAN Event History
                                Current Date -- 8/17/02 10:57:12 AM
-----Date-----Time-----Event-----
-----SCROLL UP-----
08/17/02 10:39:37 * Line Failure: Switching to backup port
08/17/02 10:38:51 * Line Recovery: Switching to primary port
08/17/02 10:37:42 * Line Failure: Switching to backup port
08/17/02 10:35:53 --Device restarted-----
08/17/02 10:04:48 --Device restarted-----
08/17/02 10:04:13 --Device restarted-----
08/17/02 08:59:01 --Device restarted-----
08/17/02 09:12:09 --Device restarted-----
08/17/02 10:31:08 --Device restarted-----
08/17/02 09:47:57 >>WAN: ADSL 1 deactivated
08/17/02 09:47:56 >>WAN: ADSL 1 activated at 10000 Kbps
08/17/02 09:42:07 --Device restarted-----
08/17/02 09:29:45 --Device restarted-----
08/17/02 11:29:44 --Device restarted-----
-----SCROLL DOWN-----
Clear History...

Return/Enter on event item for details or SCROLL [UP/DOWN] item for scrolling.
  
```

---

## SNMP Support

The router supports objects for determining the state of backup, as well as providing traps for the backup and recovery events. No objects support configuration of backup or recovery.

---

## Backup Default Gateway

Introduced in version 5.1.2, the firmware offers backup functionality to an alternate gateway typically connected to a LAN port.

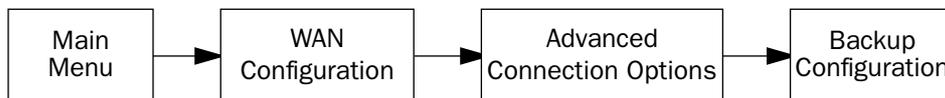
A typical application would be to have a LAN connection from your 4000-Series router to another router that has, for example, an ISDN or analog modem connection to the Internet, and designating the second router as the backup gateway. Should the primary WAN connection fail, traffic would be automatically redirected through your alternate gateway device to maintain Internet connectivity.

Two menus control the backup gateway feature:

- the **Backup Configuration** screen in the **WAN Configuration** menu  
Here, you enable the backup feature and set some parameters.
- the **IP Setup** screen in the **System Configuration** menu  
Here, you set the IP address of the alternate gateway device.

## Backup Configuration screen

To enable the backup feature, from the Main Menu select **WAN Configuration, Advanced Connection Options,** and then **Backup Configuration.**



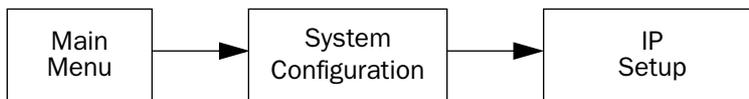


Use this setting with caution. Setting it to Yes may induce alternating switching between Backup and Recovery Mode. This field will determine the recovery behavior of a Manual backup and Ping failure backup. These two failures are treated as Layer 2 failures.

- If you enable Auto-Recovery on loss of Layer 2, the **Layer 2 Failure Timer (seconds)** field becomes visible, and you can specify how long the Auto-Recovery should wait before attempting to recover connectivity through your primary connection. This can prevent alternating switching between Backup and Recovery Mode.
- Press Escape twice to return to the Main Menu.

## IP Setup screen

To configure the backup gateway, from the Main Menu select **System Configuration** then **IP Setup**.



The IP Setup screen appears.

The IP Setup screen permits entry of a backup IP gateway address. This field is always visible, even if the **Default IP Gateway** field is not filled out, as in the case of a DHCP-acquired IP address and default gateway on the WAN interface.

IP Setup

Ethernet IP Address:	192.168.1.1
Ethernet Subnet Mask:	255.255.255.0
Define Additional Subnets...	
Default IP Gateway:	0.0.0.0
<b>Backup IP Gateway:</b>	0.0.0.0
Primary Domain Name Server:	0.0.0.0
Secondary Domain Name Server:	0.0.0.0
Domain Name:	
Receive RIP...	Both
Transmit RIP...	Off
Static Routes...	IP Address Serving...
Network Address Translation (NAT)...	

Enter an IP address in decimal and dot form (xxx.xxx.xxx.xxx).  
Set up the basic IP attributes of your Netopia in this screen.

For more information on IP Setup see the “IP Setup” on page 6-2.

**Note:** Backup and Recovery have resolutions of five seconds. This is how often the router evaluates the state of the connections and makes decisions.

## Backup Management/Statistics

If backup is enabled, the Statistics & Logs menu offers a Backup Management/Statistics option.

To view Backup Management/Statistics, from the Main Menu select **Statistics & Logs** then **Backup Management/Statistics** and press Return.



The Backup Management/Statistics screen appears.

```

Backup Management/Statistics

Current Gateway:          Primary
Backup State:            Primary Port Failure in Progress
Reason:                  Loss of Layer 1

Time Since Detection:    0:14
Switchover Time:        1:00

FORCE BACKUP
  
```

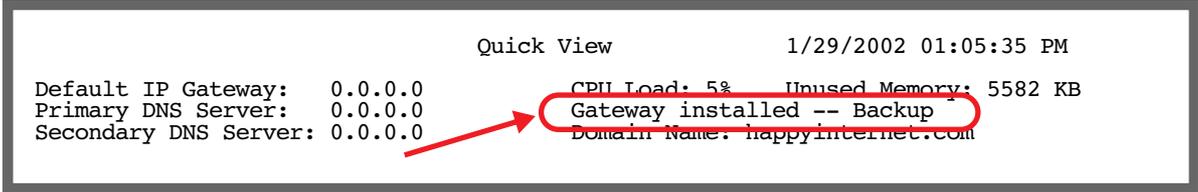
- **Current Gateway** is a display-only field that shows which port is currently in operation.
- **Backup State** is a display-only field that shows the current state of Backup or Recovery.
- **Reason** is a display-only field that shows the cause for the current state of Backup or Recovery.
- **Time Since Detection** is a display-only field that is only visible if backup or recovery is in progress. It displays the elapsed time since detection of either primary WAN line failure or re-establishment of the connection.
- **Switchover Time** is a display-only field that is only visible if backup or recovery is in progress. It displays the time until either automatic Backup or Recovery.
- The **FORCE BACKUP/FORCE RECOVERY** option is a selectable option that, depending on the current state of backup, will force the switching of ports. If you are currently in backup mode, the option will be **FORCE RECOVERY**. If you are currently in normal WAN link mode, the option will be **FORCE BACKUP**. Selecting

either one and pressing Return will force the link to switch to the other mode.

## QuickView

The QuickView screen now has an information element to indicate which gateway is in use.

```
Quick View                               1/29/2002 01:05:35 PM
Default IP Gateway: 0.0.0.0              CPU Load: 5%      Unused Memory: 5582 KB
Primary DNS Server: 0.0.0.0              Gateway installed -- Backup
Secondary DNS Server: 0.0.0.0            Domain Name: happyinternet.com
```





# Chapter 8

## Voice Configuration

This chapter describes the telephony services and configuration of the Netopia 4700-Series Integrated Access Devices (IADs) running Netopia Firmware Version 5.4.

This chapter covers the following topics:

- “Introduction” on page 8-1
- “Configuring the Voice Features” on page 8-2

---

### Introduction

Netopia IADs provide small and medium sized businesses with a complete Centrex PBX system. It supports voice call switching between the DSL link and eight local extensions. Call management features can include distinctive ringing, intelligent call forwarding, Direct Inward Dial (DID), Caller ID, and hunt groups. Important key system features such as call hold, call transfer, and call waiting are all supported.

---

**Note:** Since the Netopia IADs are Centrex-based, specific voice features available to you in Netopia Firmware Version 5.4 will depend on the services for which you contract with your service provider.

---

Netopia Firmware Version 5.4 supports up to eight telephone extensions and up to eight derived voice lines. The 4700-Series IAD family includes the Netopia data routing engine for any number of attached computers or other network devices connected to a single 10/100 Ethernet port.

Key features include:

- Fax/Modem: Configurable Voice port for incoming fax or modem calls. This is another term for echo cancellation support.
- Voice Gateway Interoperability: CopperCom, JetStream, Tollbridge TDSOft, Zhone, and Alcatel. General Bandwidth support to follow in an upcoming firmware release.

Centrex is a simpler variation on the PBX. It is a PBX with all switching occurring at a local telephone office instead of at the company's premises. Typically, the telephone company owns and manages all the communications equipment necessary to implement the PBX and then sells various services to the company.

### Explanation of terms

Some telephony terms mean different things in Centrex mode and PBX/local switching mode: Toll Restriction, Speed Dial, and Distinctive Ringing. Netopia IADs operate in Centrex mode.

- Toll Restriction Operation - Centrex Mode: When you pick up the phone, you receive a dial tone from the central office. When 9 is pressed, the Netopia IAD detects 9 and returns a busy tone served by the Centrex system accessible via the IAD. Incoming calls are allowed. This allows local extension calling through the

## 8-2 Firmware User Guide

central office, but not long distance or local calls.

Toll Restriction Operation - PBX/Local Switching Mode: When you pick up the phone, you receive local PBX dial tone. When a 9 (or outside line code) is pressed, the IAD detects the digit and returns busy (locally generated). Incoming calls are allowed. Extension calls (locally switched) are allowed.

- Speed Dial - Centrex Mode: In Centrex Mode, when you pick up the phone, dial-tone from the central office is present. It is therefore, not possible to program the phone or use speed dial in this mode from the phone.

Speed Dial - PBX/Local Switching mode: In this mode, you have the ability to pick up the phone, receive local dial tone and proceed to program the phone w/ local speed dial options. In addition, taking the phone off hook and pressing speed dial numbers will cause the stored speed dial digits to be sent out. This is independent of the previous mode.

---

## Configuring the Voice Features

This section describes how to configure the voice telephone features in Netopia Firmware Version 5.4.

From the Main Menu select **Voice Configuration**.

```
Netopia IAD

Easy Setup...
WAN Configuration...
System Configuration...
Voice Configuration...
Utilities & Diagnostics...
Statistics & Logs...
Quick Menus...
Quick View...

Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

The Voice Configuration screen appears.

## Voice Configuration

```

Voice Gateway...           CopperCom
Ring Cadence...           20 Hz
Port Configuration...

Voice Coding...           mu-law
LES Profile Number...     Profile 9

```

- Select **Voice Gateway** and from the pop-up menu, choose the type of voice gateway device to which you will be connected. The choices are: CopperCom, JetStream, TollBridge, TDSOft, Zhone, or Alcatel.
- Select **Ring Cadence** and press Return. A pop-up menu allows you to choose between 20Hz (the default), 25Hz, or 50Hz for compliance with several non-North American telephone systems.
- Selecting **Port Configuration** displays the Port Configuration screen.

## Port Configuration

```

Port 1 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 2 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 3 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 4 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 5 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 6 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 7 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K
Port 8 Echo Cancellation Enabled: Yes
Compression is G726 - ADPCM 32K

```

Return/Enter accepts \* Tab toggles \* ESC cancels.

## 8-4 Firmware User Guide

Echo cancellation is set to Yes by default. For ordinary telephone handsets, echo cancellation should be set to Yes (turned on) to eliminate echoes on the voice line. Toggling a port to No allows you to connect a fax machine or modem to the phone port (since fax machines and modems automatically cancel echoes). If you want to disable echo cancellation, toggle this item to **No**. You can enable or disable echo cancellation for each telephone port.

- The **Compression** type is normally set at the voice gateway. It is visible for informational purposes, to ascertain that the provisioning on the voice gateway is in sync with the IAD.

LES stands for Loop Emulation Service, an increasingly popular standard among ATM voice gateway manufacturers.

If the voice gateway is LES-compliant (see **LES Profile Number** below), a pop-up menu allows you to choose between G711 - PCM 64K and G726 - ADPCM 32K. Your service provider must supply you with the correct provisioning information. The reason is that in those gateway types the voice gateway expects this type of provisioning to be done prior to making any voice calls.

If the voice gateway is not LES-compliant, the pop-up menus are not available, and these fields are for information only.

Once you have made your settings for each voice port, press Escape to return to the Voice Configuration menu.

- Select **Voice Coding** and press Return. From the pop-up menu choose the voice coding method you will be using. The default is mu-law, which is the standard 8-bit, 8 kHz, mono format intended primarily for the requirements of voice in North America. You can also choose a-law, a more common audio format outside North America.
- If your service provider is using an LES-compliant voice gateway, the **LES Profile Number** option becomes visible. From the pop-up menu choose either Profile 9 or Profile 10.

The Netopia Firmware Version 5.4 supports LES profile 9 and LES profile 10. LES profile 9 includes only PCM calls. LES profile 10 includes PCM and ADPCM capabilities.

# Chapter 9

## Monitoring Tools

This chapter discusses the Router's device and network monitoring tools. These tools can provide statistical information, report on current network status, record events, and help in diagnosing and locating problems.

This section covers the following topics:

- “Quick View Status Overview” on page 9-1
- “Statistics & Logs” on page 9-4
- “Event Histories” on page 9-4
- “IP Routing Table” on page 9-7
- “General Statistics” on page 9-7
- “System Information” on page 9-9
- “Simple Network Management Protocol (SNMP) - V2c” on page 9-10

---

### Quick View Status Overview

You can get a useful, overall status report from the Netopia Firmware Version 5.4 in the Quick View screen. To go to the Quick View screen, select **Quick View** in the Main Menu.



The Quick View screen has three status sections:

- General status
- Current DSL Status
- LED Status



## Current status

The current status section is a table showing the current status of the DSL connection. For example:

```

Current DSL Status
Profile Name-----Rate--%Use-Remote Address-----Est.-More Info-----
ISP                1536  10  IP 92.163.4.1      Lcl NAT 192.163.100.6

```

**Profile Name:** Lists the name of the connection profile being used, if any.

**Rate:** Shows the line rate for this connection.

**%Use:** Indicates the average percent utilization of the maximum capacity of the channels in use for the connection.

**Remote Address:** Shows the IP address of the connected remote router.

**Est:** Indicates whether the connection was locally (“Lcl”) or remotely (“Rmt”) established.

**More Info:** Indicates the NAT address in use for this connection.

## Status lights

This section shows the current real-time status of the Router’s status lights (LEDs). It is useful for remotely monitoring the router’s status. The Quick View screen’s arrangement of LEDs corresponds to the physical arrangement of LEDs on the router. These LEDs and the corresponding display in the console menu screen will vary by model.

```

LED Status
-PWR---ERROR---ETHERNET---DSL- - - - - +-----LEDS-----
G      -      -      -                | '- '= Off 'G' = Green
                                           | 'R' = Red 'Y' = Yellow

```

Each LED representation can report one of four states:

–: The LED is off.

**R:** The LED is red.

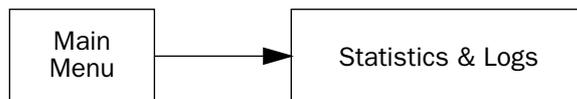
**G:** The LED is green.

**Y:** The LED is yellow.

The section “Netopia Router status lights” in the *Getting Started Guide* describes the meanings of the colors for each LED.

---

## Statistics & Logs



When you are troubleshooting your Router, the Statistics & Logs screens provide insight into the recent event activities of the router.

From the Main Menu go to Statistics & Logs and select one of the options described in the sections below.

---

## Event Histories



The Netopia Firmware Version 5.4 records certain relevant occurrences in event histories. Event histories are useful for diagnosing problems because they list what happened before, during, and after a problem occurs. You can view two different event histories: one for the router's system and one for the WAN. Some Netopia Routers have a built-in battery backup which prevents loss of event history from a shutdown or reset.

The router's event histories are structured to display the most recent events first, and to make it easy to distinguish error messages from informational messages. Error messages are prefixed with an asterisk. Both the WAN Event History and Device Event History retain records of the 128 most recent events.

In the Statistics & Logs screen, select **WAN Event History** or **Device Event History**.

## WAN Event History

The WAN Event History screen lists a total of 128 events on the WAN. The most recent events appear at the top.

```

                                WAN Event History
                                Current Date -- 10/11/2001 03:02:23 PM
-----Date-----Time-----Event-----
-----SCROLL UP-----
07/03/98 13:59:06   DSL: IP up, channel 1, gateway: 173.166.107.1
07/03/98 13:59:05   DSL: Channel 1 up
07/03/98 13:59:05  >>WAN: data link activated at 1040 Kbps
07/03/98 13:58:32  --Device restarted-----
07/03/98 12:46:39  --Device restarted-----
07/03/98 11:45:57  --Device restarted-----
07/02/98 17:58:15   DSL: IP up, channel 1, gateway: 173.166.107.1
07/02/98 17:58:10   DSL: Channel 1 up
07/02/98 17:58:10  >>WAN: data link activated at 1040 Kbps
07/02/98 17:57:05   DSL: IP down, channel 1
07/02/98 17:57:05   Link 1 down: No Synch
07/02/98 17:57:05  >>WAN: data link deactivated
07/02/98 17:48:02   DSL: IP up, channel 1, gateway: 173.166.107.1
07/02/98 17:48:01   DSL: Channel 1 up
-----SCROLL DOWN-----
Clear History...

Return/Enter on event item for details or SCROLL [UP/DOWN] item for scrolling.

```

Each entry in the list contains the following information:

**Date:** Date of the event.

**Time:** Time of the event.

**Event:** A brief description of the event.

**Ch.:** The channel involved in the event.

The first event in each call sequence is marked with double arrows (>>).

Failures are marked with an asterisk (\*).

If the event history exceeds the size of the screen, you can scroll through it by using the SCROLL UP and SCROLL DOWN items.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

To get more information about any event listed in the WAN Event History, select the event and then press Return. A dialog box containing more information about the selected event will appear. Press Return or Escape to dismiss the dialog box.

To clear the event history, select **Clear History** at the bottom of the history screen and press Return.

## Device Event History

The Device Event History screen lists a total of 128 port and system events, giving the time and date for each event, as well as a brief description. The most recent events appear at the top.

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In the Statistics & Logs screen, select **Device Event History**. The Device Event History screen appears.

```

                                Device Event History
                                Current Date -- 10/11/2001 03:02:23 PM
-----Date-----Time-----Event-----
-----SCROLL UP-----
01/22/02 02:03:11  IP address server initialization complete
01/22/02 02:03:11 --BOOT: Warm start v5.3
01/22/02 02:02:32  IP address server initialization complete
01/22/02 02:02:32 --BOOT: Warm start v5.3
01/22/02 01:59:50 * IP: Route 0.0.0.0/0.0.0.0 not installed
01/22/02 01:59:50  IP address server initialization complete
01/22/02 01:59:50 --BOOT: Cold start v5.3
01/22/02 01:55:07 * IP: Route 0.0.0.0/0.0.0.0 not installed
-----SCROLL DOWN-----
Clear History...
```

Return/Enter on event item for details or SCROLL [UP/DOWN] item for scrolling.

If the event history exceeds the size of the screen, you can scroll through it by using SCROLL UP and SCROLL DOWN.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

To obtain more information about any event listed in the Device Event History, select the event and then press Return. A dialog box containing more information about the selected event appears. Press Return or Escape to dismiss the dialog box.

To clear the Device Event History, select **Clear History** and press Return.

## IP Routing Table



The IP routing table displays all of the IP routes currently known to the Router.

IP Routing Table					
Network Address	Subnet Mask	via Router	Port	Type	
0.0.0.0	255.0.0.0	0.0.0.0	--	Other	
127.0.0.1	255.255.255.255	127.0.0.1	Loopback	Local	
192.168.1.0	255.255.255.240	192.168.1.1	Ethernet	Local	
192.168.1.1	255.255.255.255	192.168.1.1	Ethernet	Local	
192.168.1.15	255.255.255.255	192.168.1.15	Ethernet	Bcast	
224.0.0.0	224.0.0.0	0.0.0.0	--	Other	
255.255.255.255	255.255.255.255	255.255.255.255	--	Bcast	

-----SCROLL UP-----

-----SCROLL DOWN-----

UPDATE

The routing table screen represents a snapshot of the routing table information at the time the screen is first invoked. To take a new snapshot, select **Update** at the bottom of the screen and press Return.

## General Statistics



The General Statistics screen displays information about data traffic on the Router's data ports. This information is useful for monitoring and troubleshooting your LAN. Note that the counters roll over at their maximum field width, that is, they restart again at 0.

General Statistics						
Physical I/F	Rx Bytes	Tx Bytes	Rx Pkts	Tx Pkts	Rx Err	Tx Err
Ethernet Hub	1234567	123456	123456	123456	123456	12345
ATM ADSL 1	1234567	123456	123456	123456	123456	12345

Network	Rx Bytes	Tx Bytes	Rx Pkts	Tx Pkts	Rx Err	Tx Err
IP	1234567	123456	123456	123456	123456	12345

VC Traffic Statistics...

### Physical Interface

The top left side of the screen lists total packets received and total packets transmitted for the following data ports:

- Ethernet
- DSL

### Network Interface

The bottom left side of the screen lists total packets received and total packets transmitted:

- IP (IP packets on the Ethernet)

The right side of the table lists the total number of occurrences of each of six types of communication statistics:

**Rx Bytes.** The number of bytes received

**Tx Bytes.** The number of bytes transmitted

**Rx Packets:** The number of packets received

**Tx Pkts.** The number of packets transmitted

**Rx Err:** The number of bad Ethernet packets received

**Tx Err:** The number of errors occurring when Ethernet packets are transmitted simultaneously by nodes on the LAN

---

## System Information

The System Information screen gives a summary view of the general system level values in the Router. From the Statistics & Logs menu select **System Information**. The System Information screen appears.

System Information	
Serial Number	ff-70-00 (16740352)
Firmware Version	5.4
ModelNumber	4541200
Processor Speed (Mhz)	50
Flash Rom Capacity (MBytes)	2
DRAM Capacity (MBytes)	16
Hardware Acceleration	Not Installed
Ethernet	Single 10/100 Port
WAN Interface	ADSL

The information display varies by model, firmware version, feature set, and so on. You can tell at a glance your particular system configuration.

---

## Simple Network Management Protocol (SNMP) - V2c

The Netopia Firmware Version 5.4 includes a Simple Network Management Protocol (SNMP) agent, allowing monitoring and configuration by a standard SNMP manager. Netopia Routers and IADs now support both SNMP-V1 and SNMP-V2c.

### Enterprise-specific SNMP Changes

Enterprise-specific SNMP changes in Netopia Firmware Version 5.4 include restarting the device as a bridge or router, and controlling the 'WAN changes reset immediately' item.

**Restart Item:** The OID responsible for restarting the router can now tell it to startup as a router or a bridge. Note that if the device was a router and is now told to be a bridge (or vice-versa) the device will be factory defaulted.

**WAN Changes take effect immediately:** This item is found in the console menu and is now added as an SNMP OID. The router will reboot if the value is changed.

These changes have been added to the SNMP MIB file **NETOPIA.MIB**.

This MIB is available by anonymous ftp from the Netopia ftp server.

MIBs are available in a variety of formats. Load this MIB into your SNMP management software. Follow the instructions included with your SNMP manager on how to load MIBs.

The Netopia Firmware Version 5.4 supports the following management information base (MIB) documents:

- MIB II (RFC 1213)
- Interface MIB (RFC 1229)
- Ethernet MIB (RFC 1643)
- Netopia MIB
- **SNMP-v2 Traps:** SNMP v2 MIB (RFC1907) v2 traps only; **npaV2trap.mib** (Netopia-specific)
- **ATM:** ATM TC (RFC2514); ATM MIB (RFC2515)
- **ADSL:** ADSL MIB (RFC2662)

These MIBs are on the Netopia CD included with the Router. Load these MIBs into your SNMP management software in the order they are listed here. Follow the instructions included with your SNMP manager on how to load MIBs.

You can also obtain the latest updated SNMP MIBs from the Netopia anonymous FTP server.

FTP to: ***ftp.netopia.com/pub/router/snmpinfo***.

## The SNMP Setup screen

From the Main Menu, select **SNMP** in the System Configuration screen and press Return. The SNMP Setup screen appears.



SNMP Setup

System Name:  
 System Location:                   +-----+  
 System Contact:                   +-----+  
 System Trap Version:               | SNMP-V1 |  
                                       | SNMP-V2c |  
                                       +-----+  
 Read-Only Community String:  
 Read/Write Community String:

Authentication Traps Enable:       Off

IP Trap Receivers...

Follow these steps to configure the first three items in the screen:

1. Select **System Name** and enter a descriptive name for the Router's SNMP agent.
2. Select **System Location** and enter the router's physical location (room, floor, building, etc.).
3. Select **System Contact** and enter the name of the person responsible for maintaining the router.
4. Select the **SNMP Trap Version** and choose either SNMP-V1 or SNMP-V2c. SNMP-V2c is a more feature-rich version, but is not supported by all vendors. Consult with your service provider.

System Name, System Location, and System Contact set the values returned by the Router SNMP agent for the SysName, SysLocation, and SysContact objects, respectively, in the MIB II system group. Although optional, the information you enter in these items can help a system administrator manage the network more efficiently.

## Community strings

The **Read-Only Community String** and the **Read/Write Community String** are like passwords that must be used by an SNMP manager querying or configuring the Netopia Firmware Version 5.4. An SNMP manager using the **Read-Only Community String** can examine statistics and configuration information from the router, but cannot modify the router's configuration. An SNMP manager using the **Read/Write Community String** can both examine and modify configuration parameters.

By default, the read-only and read/write community strings are set to public and private, respectively. You should change both of the default community strings to values known only to you and trusted system administrators.

To change a community string, select it and enter a new value.

Setting the Read-Only and Read-Write community strings to the empty string will block all SNMP requests to the router. (The router may still send SNMP Traps if those are properly enabled.)

Previously, if either community string was the empty string, SNMP Requests specifying an empty community string were accepted and processed.

This change is designed to allow the administrator to block SNMP access to the router and to provide more granular control over the allowed SNMP operations to the router.

- Setting only the Read-Write community string to the empty string will block SNMP Set Requests to the router, but Get Requests and Get-Next Requests will still be honored using the Read-Only community string (assuming that is not the empty string).
- Setting only the Read-Only community string to the empty string will *not* block Get Requests or Get-Next Requests since those operations (and Set Requests) are still allowed using the (non-empty) Read-Write community string.

Even if you decide not to use SNMP, you should change the community strings. This prevents unauthorized access to the Router through SNMP. For more information on security issues, see [“Suggested Security Measures” on page 10-1](#).

## SNMP traps

An SNMP trap is an informational message sent from an SNMP agent (in this case, the Router) to a manager. When a manager receives a trap, it may log the trap as well as generate an alert message of its own.

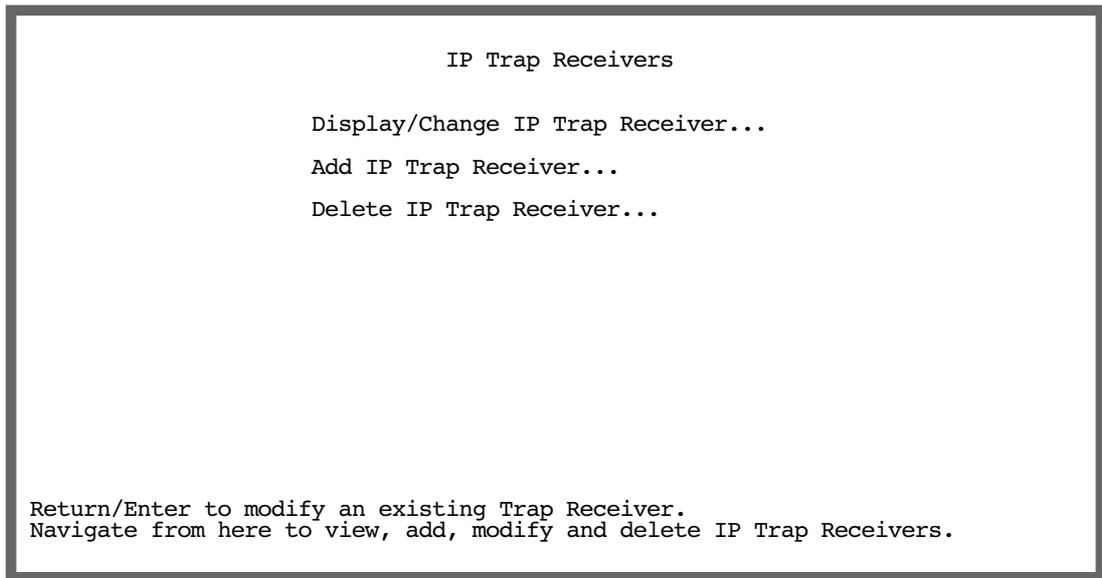
Standard traps generated by the Netopia Firmware Version 5.4 include the following:

- An authentication failure trap is generated when the router detects an incorrect community string in a received SNMP packet. **Authentication Traps Enable** must be **On** for this trap to be generated.
- A cold start trap is generated after the router is reset.
- An interface down trap (ifDown) is generated when one of the router's interfaces, such as a port, stops functioning or is disabled.
- An interface up trap (ifUp) is generated when one of the router's interfaces, such as a port, begins functioning.

The Netopia Firmware Version 5.4 sends traps using UDP (for IP networks).

You can specify which SNMP managers are sent the IP traps generated by the Netopia Firmware Version 5.4. Up to eight receivers can be set. You can also review and remove IP traps.

To go to the IP Trap Receivers screen, select **IP Trap Receivers**. The IP Trap Receivers screen appears.



### ***Setting the IP trap receivers***

1. Select **Add IP Trap Receiver**.
2. Select **Receiver IP Address or Domain Name**. Enter the IP address or domain name of the SNMP manager you want to receive the trap.
3. Select **Community String** if you enabled one in the SNMP Setup screen, and enter the appropriate password.
4. Select **Add Trap Receiver Now** and press Return. You can add up to seven more receivers.

### ***Viewing IP trap receivers***

To display a view-only table of IP trap receivers, select **Display/Change IP Trap Receiver** in the IP Trap Receivers screen.

### ***Modifying IP trap receivers***

1. To edit an IP trap receiver, select **Display/Change IP Trap Receiver** in the IP Trap Receivers screen.
2. Select an IP trap receiver from the table and press Return.
3. In the **Change IP Trap Receiver** screen, edit the information as needed and press Return.

### ***Deleting IP trap receivers***

1. To delete an IP trap receiver, select **Delete IP Trap Receiver** in the IP Trap Receivers screen.
2. Select an IP trap receiver from the table and press Return.
3. In the dialog box, select **Continue** and press Return.



# Chapter 10

## Security

The Netopia Firmware Version 5.4 provides a number of security features to help protect its configuration screens and your local network from unauthorized access. Although these features are optional, it is strongly recommended that you use them.

This section covers the following topics:

- “Suggested Security Measures” on page 10-1
- “Console Tiered Access – Two Password Levels” on page 10-2
- “User Accounts” on page 10-15
- “Telnet Access” on page 10-17
- “About Filters and Filter Sets” on page 10-18
- “Working with IP Filters and Filter Sets” on page 10-26
- “Policy-based Routing using Filtersets” on page 10-34
- “Firewall Tutorial” on page 10-37
- “Configuration Management” on page 10-44
- “Call Filtering” on page 10-48

---

## *Suggested Security Measures*

In addition to setting up user accounts, Telnet access, and filters (all of which are covered later in this chapter), there are other actions you can take to make the Router and your network more secure:

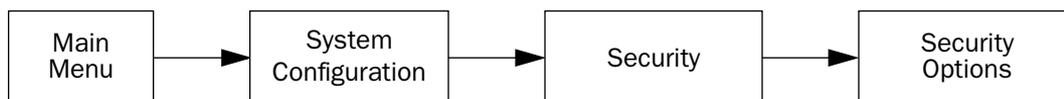
- Change the SNMP community strings (or passwords). The default community strings are universal and could easily be known to a potential intruder.
- Set the answer profile so it must match incoming calls to a connection profile.
- Leave the Enable Dial-in Console Access option set to No.
- Configure the Netopia Firmware Version 5.4 through the serial console port, if available, to ensure that your communications cannot be intercepted.

## Console Tiered Access – Two Password Levels

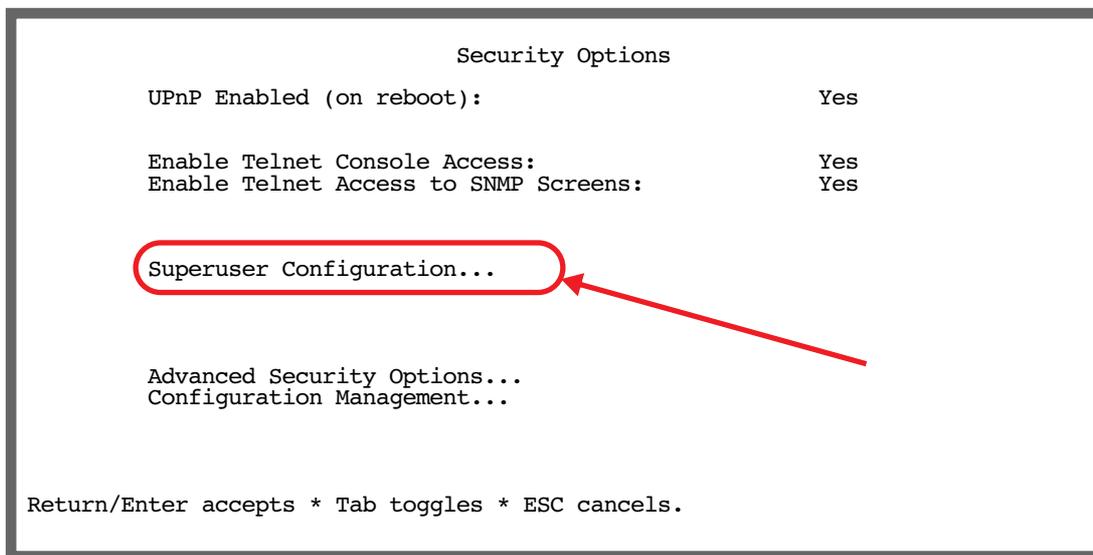
Netopia Firmware Version 5.4 offers tiered access control for greater security and protection against accidental or malicious misconfiguration. Service providers and network administrators can now limit the access of other users to the various configuration screens to prevent misconfigurations.

The access privileges of various users that may be assigned are governed by a *Superuser* administrative account. The Superuser can assign different privileges to *Limited* users who will be accessing the router functions in some way.

Configuration access names and passwords are specified in the **Security Options** screen. From the Main Menu, select **System Configuration**, then **Security**.



The **Security Options** screen appears.



## UPnP Support

**UPnP Enabled:** Universal Plug and Play (UPnP™) is a set of protocols that allows a PC to automatically discover other UPnP devices (anything from an internet gateway device to a light switch), retrieve an XML description of the device and its services, control the device, and subscribe to real-time event notification.

By default, UPnP is enabled on the Netopia Gateway.

For Windows XP users, the automatic discovery feature places an icon representing the Netopia Gateway automatically in the “My Network Places” folder. Be sure that the Windows XP service **Universal Plug and Play Device Host** is enabled and running, otherwise you might not see the icon.

Double clicking the icon will launch a telnet window to your Gateway’s Telnet interface.

PCs using UPnP can retrieve the Gateway’s WAN IP address, and automatically create NAT port maps. This means that applications that support UPnP, and are used with a UPnP-enabled Netopia Gateway, will not need application layer gateway support on the Netopia Gateway to work through NAT.

You can disable UPnP, if you are not using any UPnP devices or applications.

## Superuser configuration

The access privileges of the Superuser account are not modifiable. It is possible, however, to control who can log in as Superuser. You can limit this to serial console only.

Select **Superuser Configuration** and press **Return**.

The Superuser Configuration screen appears.

Superuser Configuration

Name (19 characters max):            admin

Password:

Telnet Access Enabled:                Yes

Web Access Enabled:                    Yes

ADD SUPERUSER                            CANCEL

- Assign a Superuser **Name**. It can be up to 19 characters long. It is good practice *not* to use any easily-guessed combination such as your birthday.
  - Assign a **Password**. Keep this password secure. If you lose or forget it, you will not be able to access the router without factory defaulting it, thereby losing all of your configuration information.
  - You can disable Telnet or Web Access. This may be useful for extra security in preventing remote attempts to access the router.
  - Select **ADD SUPERUSER** and press **Return**. The Superuser account is now configured.
- You will be challenged for this name and password every time you attempt to log into the router.



Access Privileges (Custom)

WAN Data Configuration: No  
 Connection Profile Configuration: No  
 Circuit (PVC/DLCI) Configuration: No

LAN Data Configuration: Yes  
 LAN Subnet Configuration: Yes  
 NAT/Filters Configuration: Yes

Preferences (Global) Configuration: Yes

Voice Configuration: Yes

OK CANCEL

You can toggle the default user privileges for each user. The defaults are set to minimize the possibility of an individual user inadvertently damaging the WAN connection. Exercise caution in assigning privileges other than these defaults to limited users.

Access Privilege	Default
WAN Data Configuration	No
Connection Profile Configuration	No
Circuit (PVC/DLCI) Configuration	No
LAN Data Configuration	Yes
LAN Subnet Configuration	Yes
NAT/Filters Configuration	Yes
Preferences (Global) Configuration	Yes
Voice Configuration (IADs only)	Yes

## Advanced Security Options

The Advanced Security Options screen allows you to configure the global access privileges of users authenticated via a RADIUS server.

From the Security Options screen, select **Advanced Security Options**. The Advanced Security Options screen appears.

```

                                Advanced Security Options

Security Databases...                Local only

RADIUS Server Addr/Name:
RADIUS Server Secret:
Alt RADIUS Server Addr/Name:
Alt RADIUS Server Secret:
RADIUS Identifier:
RADIUS Server Authentication Port:
RADIUS Access Privileges...
                                +-----+
                                | All      |
                                | LAN      |
                                | WAN      |
                                | VOX     |
                                | Custom...|
                                +-----+

Telnet Server Port:

LAN (Ethernet) IP Filter Set...
Remove Filter Set

```

- Select **RADIUS Access Privileges**, and from the pull-down menu, choose which access privilege you want this user to have: **All**, **LAN**, **WAN**, or for IADs only, **VOX**.

If you assign any of these privileges, limited users will have full access to privileges associated with these interfaces. You can customize these privileges further, in order to limit access to only certain portions of those interfaces' configuration, by selecting **Custom**. If you select Custom, the **Access Privileges (Custom)** screen appears.

```

                                Access Privileges (Custom)

WAN Data Configuration:           Yes
Connection Profile Configuration: Yes
Circuit (PVC/DLCI) Configuration: Yes

LAN Data Configuration:          Yes
LAN Subnet Configuration:        Yes
NAT/Filters Configuration:       Yes

Preferences (Global) Configuration: Yes

                                OK                                CANCEL

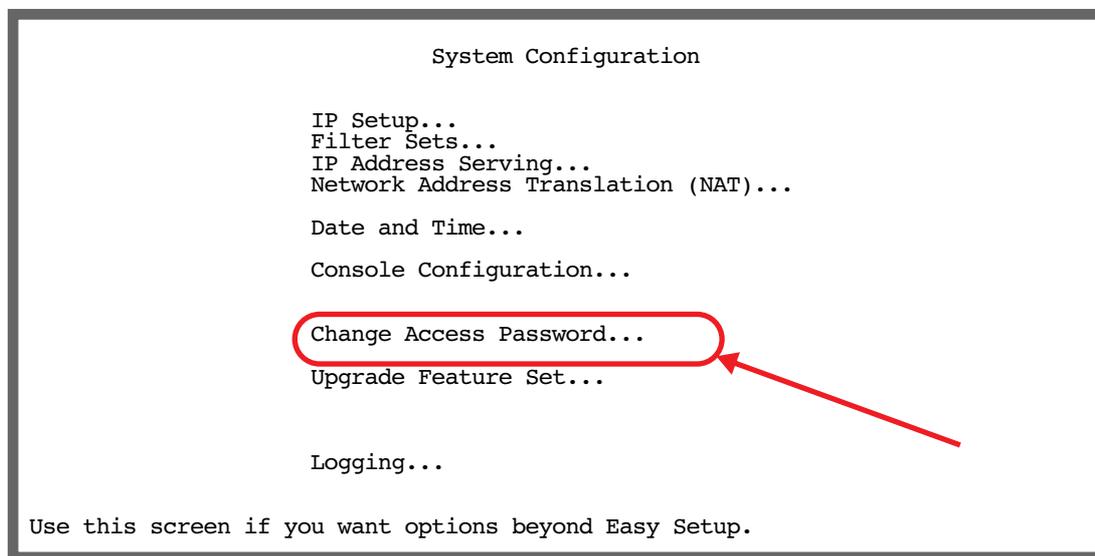
Return/Enter accepts * Tab toggles * ESC cancels.

```

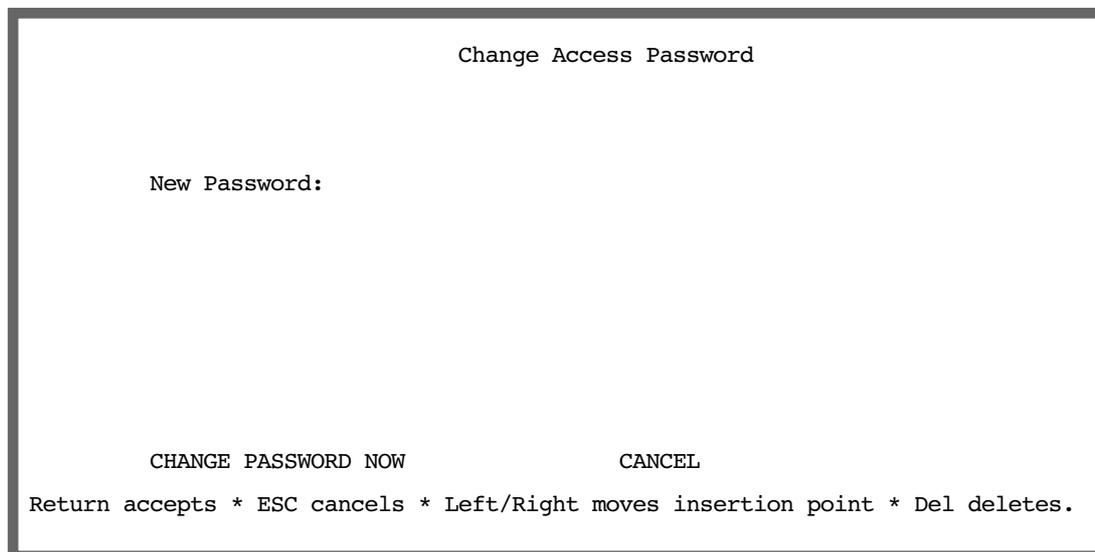
Since authentication via RADIUS server is, by definition, authentication of remote users, the WAN-related defaults are preset to Yes. Toggle any that should be changed.

## User access password

Users must be able to change their names and passwords, regardless of other security access restrictions. If a user does not have security access, then they will only be able to modify the password for their account. When a limited-access user logs into the router, and accesses the System Configuration menus, the only Security option displayed is **Change Access Password**.



Selecting this option displays the **Change Access Password** screen.



When changing a password, you will be challenged to enter it again to be sure you have entered it correctly.

## User menu differences

Menus reflect the security access level of the user. Consequently, configuration menus will display differing options based upon the parameters a particular user is allowed to change. Some differences include:

- Limited users (non-Superusers) do not have access to Easy Setup.
- All users have access to System Configuration, Quick Menus, and Quick View, but limited users have only limited access to configuration elements in their descendant menus.
- Configuration screen elements to which configuration access is forbidden are usually hidden.
- The Quick Menus screen reflects the security access level of the user. Menus to which configuration access is forbidden are hidden.

## Main Menu

The following is an example comparison of the Main Menu as seen by the Superuser and by a Limited user.

### Superuser

```
Netopia Router

Easy Setup...
WAN Configuration...
System Configuration...
Utilities & Diagnostics...
Statistics & Logs...
Quick Menus...
Quick View...

Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

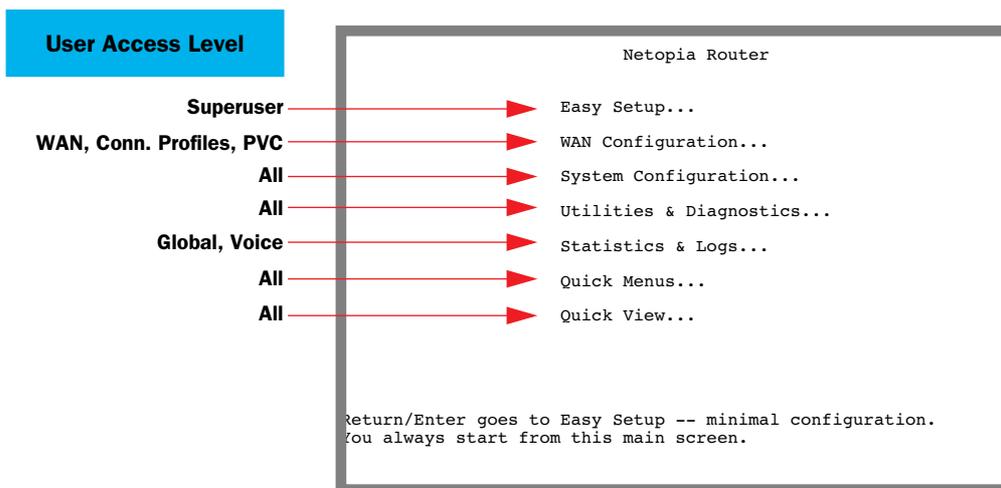
### Limited user

```
Netopia Router

System Configuration...
Utilities & Diagnostics...
Statistics & Logs...
Quick Menus...
Quick View...

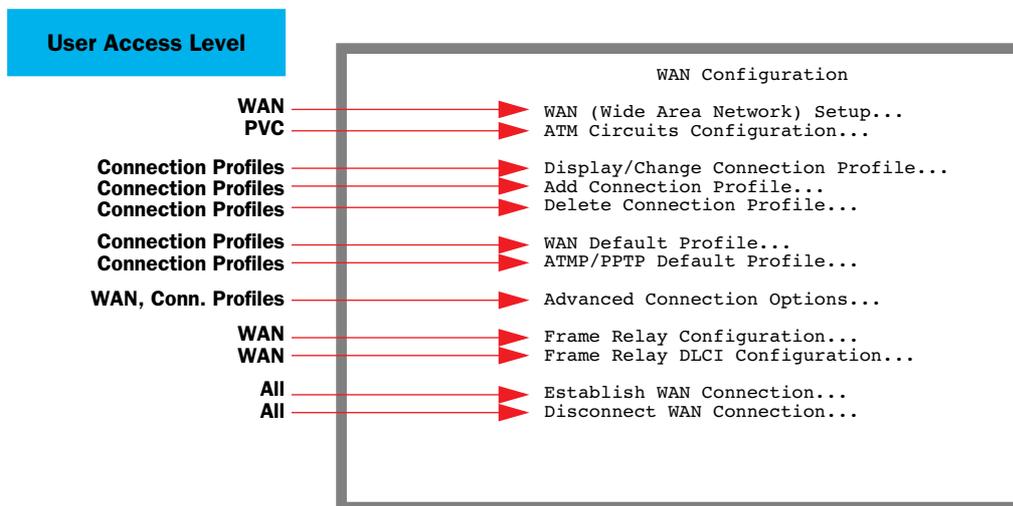
Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

Based on access level, the Main Menu displays its configuration options according to the following diagram:

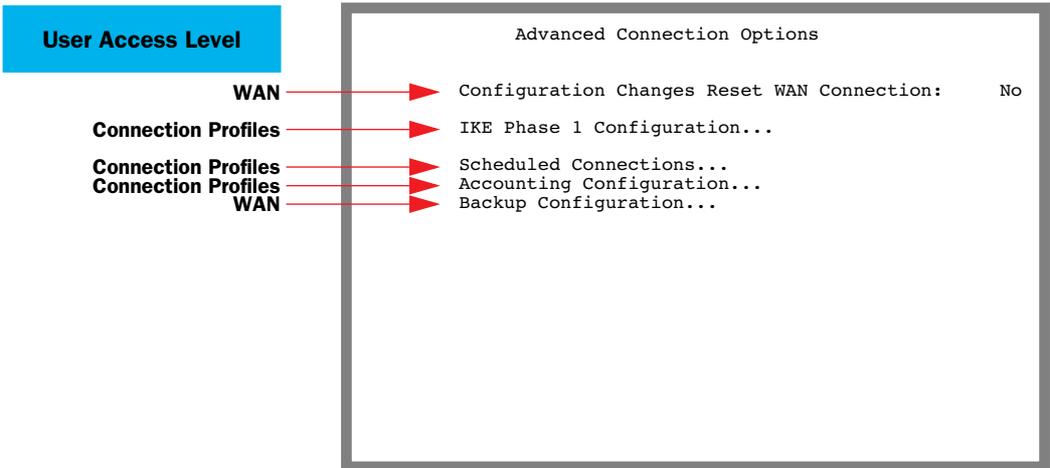


## WAN Configuration screens

If a limited user is allowed WAN, Connection Profile, or PVC configuration access, the WAN Configuration option in the Main Menu is visible. If a limited user selects **WAN Configuration** in the Main Menu, the WAN Configuration screen displays its configuration options according to the following diagram:



If a limited user selects **Advanced Connection Options** in the WAN Configuration menu, the Advanced Connection Options screen displays its configuration options according to the following diagram:



### Connection Profiles

The Superuser can disallow limited user access to a particular Connection Profile. When adding a Connection Profile in the Add Connection Profile screen the Superuser can toggle the **Superuser Accessible Only** option to **Yes** or **No**.

Add Connection Profile

Profile Name: Profile 1  
 Profile Enabled: Yes  
 Encapsulation Type... PPP  
 Encapsulation Options...  
 IP Profile Parameters...

**Superuser Accessible Only: No**

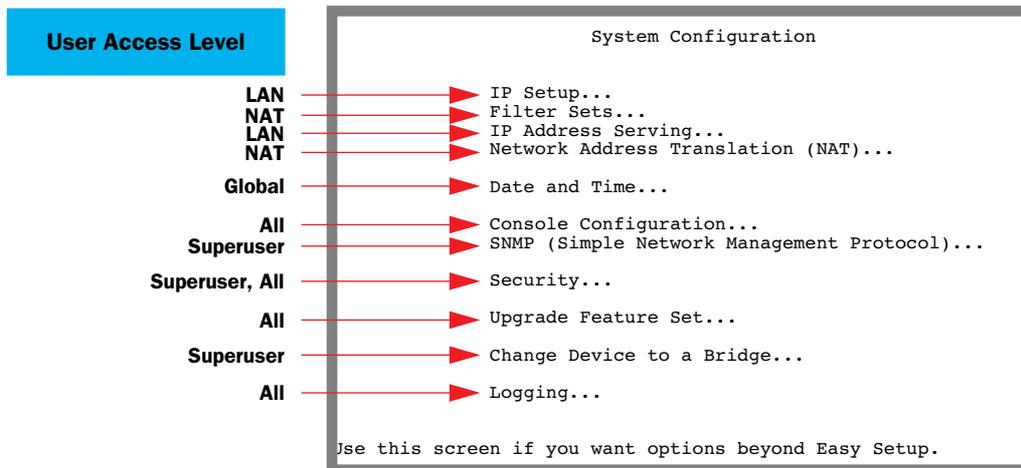
COMMIT CANCEL

Return/Enter to accept the profile.  
 Configure a new Conn. Profile. Finished? COMMIT or CANCEL to exit.

This option is visible whether or not there are authorized username/passwords other than the Superuser. The Superuser can also change the user accessibility after creating a Connection Profile or a limited user in the **Change Connection Profile** screen.

## System Configuration menu

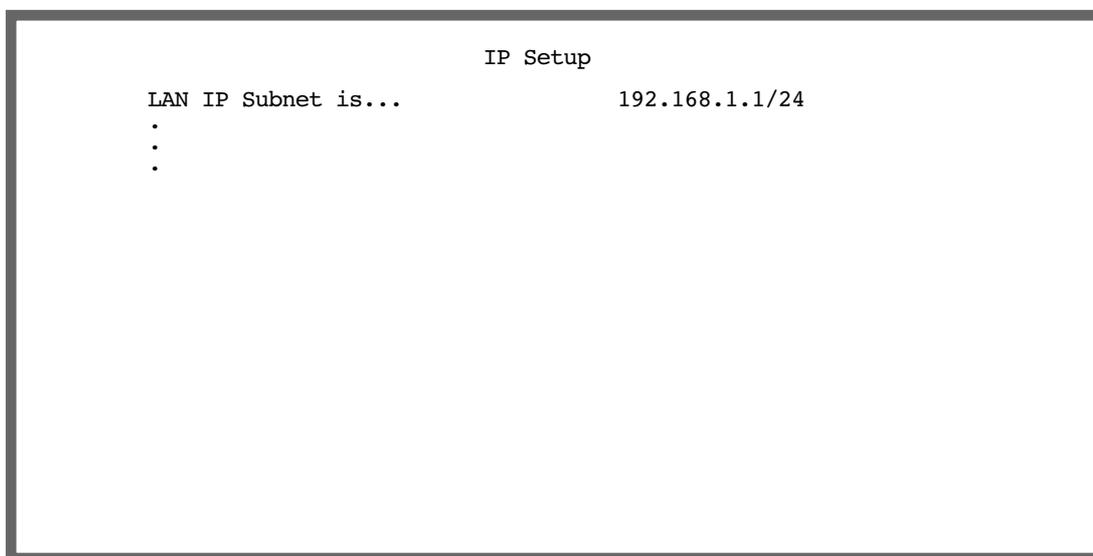
The System Configuration menu is always available to all users. Based on access level, the System Configuration menu displays its configuration options according to the following diagram:



**Note:** Network Address Translation (NAT) is displayed in this screen in order to make access control simpler. Security becomes **Change Access Password** for non-Superusers, and provides access to the associated menu described previously.

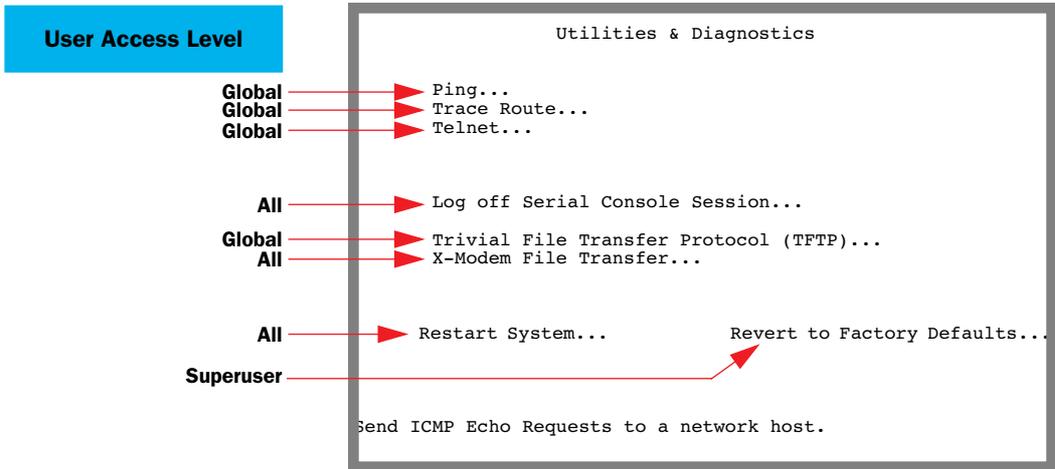
## IP Setup menu

In the IP Setup menu, users that do not have LAN Subnet Configuration access will see a screen similar to the following:



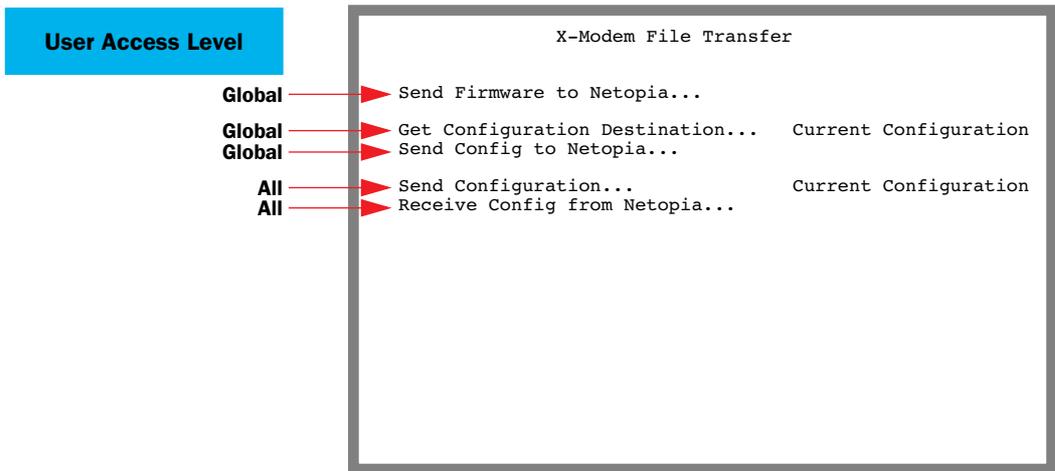
## Utilities & Diagnostics menu

Based on access level, the Utilities & Diagnostics menu displays its configuration options according to the following diagram:



## X-Modem File Transfer menu

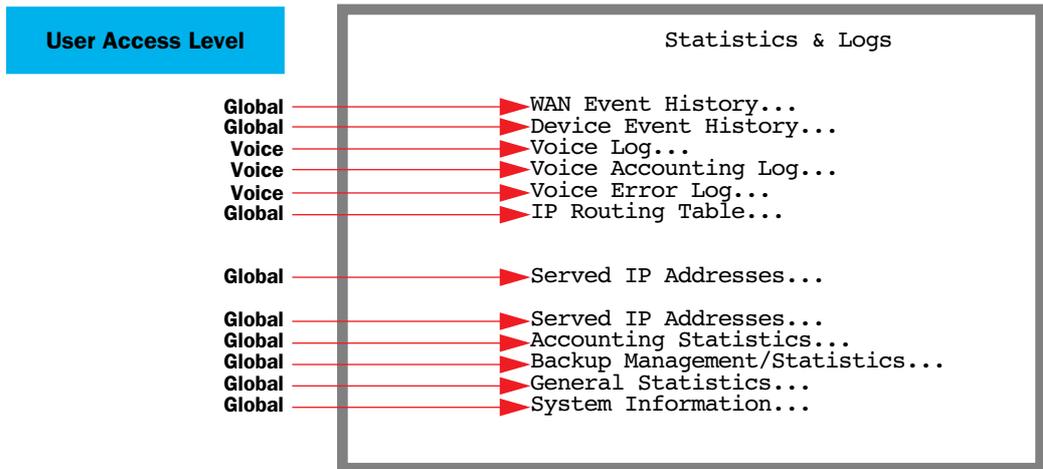
Based on access level, the X-Modem File Transfer menu displays its configuration options according to the following diagram:



## Statistics & Logs menu

The Statistics & Logs menu shown below is a composite of all the possible options on all Netopia routers and IADs supported by the firmware. Substantial differences exist among screens on a given router or IAD. Here, all selection options are shown.

Based on access level, the Statistics & Logs menu displays its options according to the following diagram:



## Quick Menus

Quick Menus vary considerably between models, features, and access levels. The following is an example comparison of the Quick Menu as seen by the Superuser and by a Limited user.

### Superuser

```

Quick Menu

Connection Profiles
Add Connection Profiles
Change Connection Profiles
Delete Connection Profiles
WAN Default Profile
ATMP/PPTP Default Profile
IKE Phase 1 Config
Scheduled Connections
Add Scheduled Connection
Change Scheduled Connection
Delete Scheduled Connection

Console Configuration
SNMP Setup

Line Configuration
Fr. Relay Config
Fr. Relay DLCI Config
Backup Config
Telephone Setup

MacIP Setup
X-Modem File Transfer
TFTP

IP Setup
IP Address Serving Setup
IP Filter Sets
Static Routes
Network Address Translation

AURP Setup
    
```

### Limited user

```

Quick Menu

IP Setup
IP Address Serving Setup
Filter Sets
Static Routes
Network Address Translation

X-Modem File Transfer

Console Configuration
TFTP

This menu allows you to visit most configuration screens.
    
```

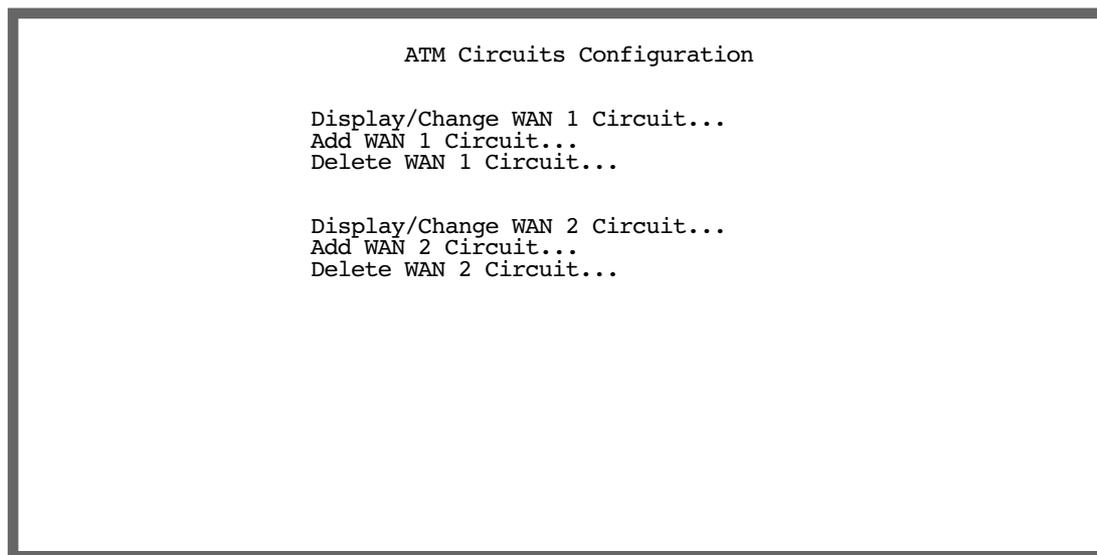
**Note:** Console Configuration is always visible.

## ATM Circuits Configuration menu

You select **ATM Circuits Configuration** from the WAN Configuration menu.



The ATM Circuits Configuration menu screen appears as follows:



**Note:** Multiple ATM circuit configuration is supported on multiple ATM-capable routers. Although some of the parameters of the Circuit Configuration screens pertain to Voice and Connection Profiles, it is assumed that if the user has been granted PVC configuration access, they are permitted configuration access to all PVC parameters.

---

## User Accounts

When you first set up and configure the Netopia Firmware Version 5.4, no passwords are required to access the configuration screens. Anyone could tamper with the router's configuration by simply connecting it to a console.

However, by adding user accounts, you can protect the most sensitive screens from unauthorized access. User accounts are composed of name/password combinations that can be given to authorized users.

### **Caution!**

You are strongly encouraged to add protection to the configuration screens. Unprotected screens could allow an unauthorized user to compromise the operation of your entire network.

Once user accounts are created, users who attempt to access protected screens will be challenged. Users who enter an incorrect name or password are returned to a screen requesting a name/password combination to access the Main Menu.

To set up user accounts, in the System Configuration screen select **Security** and press Return. The Security Options screen appears.

```
Security Options

Enable Telnet Console Access:           Yes
Enable Telnet Access to SNMP Screens:   Yes
Console Access timeout (seconds):       600

Show Users...
Add User...
Delete User...

Advanced Security Options...

Password for This Screen (11 chars max):

Return/Enter accepts * Tab toggles * ESC cancels.
Set up configuration access options here.
```

### ***Protecting the Security Options screen***

The first screen you should protect is the Security Options screen, because it controls access to the configuration screens. Access to the Security Options screen can be protected with a password.

Select **Password for This Screen** in the Security Options screen and enter a password. Make sure this password is secure and is different from any of the user account passwords.

### ***Protecting the configuration screens***

You can protect the configuration screens with user accounts. You can administer the accounts from the Security Options screen. You can create up to four accounts.

To display a view-only list of user accounts, select **Show Users** in the Security Options screen.

To add a new user account, select **Add User** in the Security Options screen and press Return. The Add Name With Write Access screen appears.

Add Name With Write Access

Enter Name:

Enter Password (11 characters max):

ADD NAME/PASSWORD NOW                      CANCEL

Follow these steps to configure the new account:

1. Select **Enter Name** and enter a descriptive name (for example, the user's first name).
2. Select **Enter Password** and enter a password.
3. To accept the new name/password combination, select **ADD NAME/PASSWORD NOW** and press Return. To exit the Add Name With Write Access screen without saving the new account, select **CANCEL**. You are returned to the Security Options screen.

To delete a user account, select **Delete User** to display a list of accounts. Select an account from the list and press Return to delete it. To exit the list without deleting the selected account, press Escape.

---

## Telnet Access

Telnet is a TCP/IP service that allows remote terminals to access hosts on an IP network. The Netopia Firmware Version 5.4 supports Telnet access to its configuration screens.

### **Caution!**

You should consider password-protecting or restricting Telnet access to the Router if you suspect there is a chance of tampering.

To password-protect the configuration screens, select Easy Setup from the Main Menu, and go to the Easy Setup Security Configuration screen. By entering a name and password pair in this screen, all access via serial, Telnet, SNMP, and Web server will be password-protected.

To restrict Telnet access, select **Security** in the Advanced Configuration menu. The Security Options screen will appear. There are two levels of Telnet restriction available:

- To restrict Telnet access to the SNMP screens, select **Enable Telnet Access to SNMP Screens** and toggle it to **No**. (See “SNMP traps” on page 9-12.)
- To restrict Telnet access to all of the configuration screens, select **Enable Telnet Console Access** and toggle it to **No**.

---

## About Filters and Filter Sets

Security should be a high priority for anyone administering a network connected to the Internet. Using packet filters to control network communications can greatly improve your network’s security.

The Netopia Firmware Version 5.4’s packet filters are designed to provide security for the Internet connections made to and from your network. You can customize the router’s filter sets for a variety of packet filtering applications. Typically, you use filters to selectively admit or refuse TCP/IP connections from certain remote networks and specific hosts. You will also use filters to screen particular types of connections. This is commonly called *firewalling* your network.

Before creating filter sets, you should read the next few sections to learn more about how these powerful security tools work.

### What’s a filter and what’s a filter set?

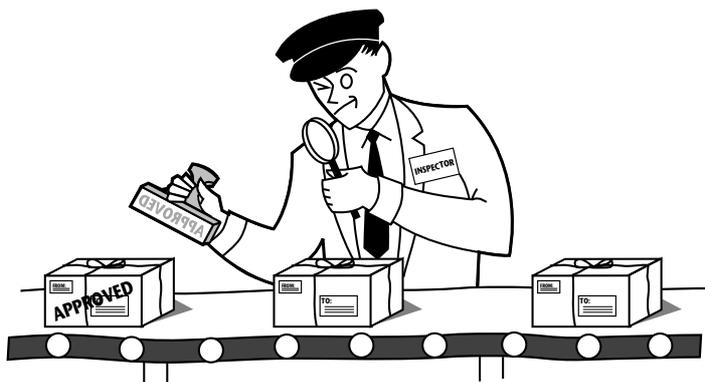
A filter is a rule that lets you specify what sort of data can flow in and out of your network. A particular filter can be either an input filter—one that is used on data (packets) coming in to your network from the Internet—or an output filter—one that is used on data (packets) going out from your network to the Internet.

A filter set is a group of filters that work together to check incoming or outgoing data. A filter set can consist of a combination of input and output filters.

### How filter sets work

A filter set acts like a team of customs inspectors. Each filter is an inspector through which incoming and outgoing packages must pass. The inspectors work as a team, but each inspects every package individually.

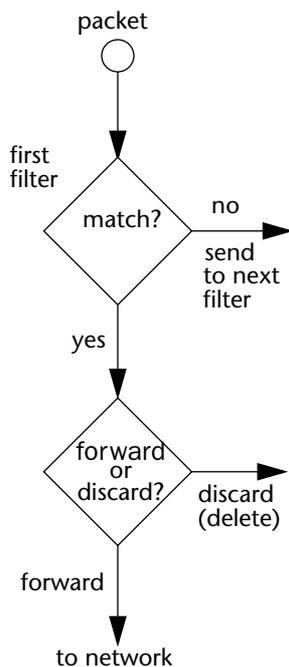
Each inspector has a specific task. One inspector's task may be to examine the destination address of all outgoing packages. That inspector looks for a certain destination—which could be as specific as a street address or as broad as an entire country—and checks each package's destination address to see if it matches that destination.



*A filter inspects data packets like a customs inspector scrutinizing packages.*

## Filter priority

Continuing the customs inspectors analogy, imagine the inspectors lined up to examine a package. If the package matches the first inspector's criteria, the package is either rejected or passed on to its destination, depending on the first inspector's particular orders. In this case, the package is never seen by the remaining inspectors.



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If the package does not match the first inspector's criteria, it goes to the second inspector, and so on. You can see that the order of the inspectors in the line is very important.

For example, let's say the first inspector's orders are to send along all packages that come from Rome, and the second inspector's orders are to reject all packages that come from France. If a package arrives from Rome, the first inspector sends it along without allowing the second inspector to see it. A package from Paris is ignored by the first inspector, rejected by the second inspector, and never seen by the others. A package from London is ignored by the first two inspectors, so it's seen by the third inspector.

In the same way, filter sets apply their filters in a particular order. The first filter applied can forward or discard a packet before that packet ever reaches any of the other filters. If the first filter can neither forward nor discard the packet (because it cannot match any criteria), the second filter has a chance to forward or reject it, and so on. Because of this hierarchical structure, each filter is said to have a priority. The first filter has the highest priority, and the last filter has the lowest priority.

## How individual filters work

As described above, a filter applies criteria to an IP packet and then takes one of three actions:

- Forwards the packet to the local or remote network
- Blocks (discards) the packet
- Ignores the packet

A filter forwards or blocks a packet only if it finds a match after applying its criteria. When no match occurs, the filter ignores the packet.

### A filtering rule

The criteria are based on information contained in the packets. A filter is simply a rule that prescribes certain actions based on certain conditions. For example, the following rule qualifies as a filter:

Block all Telnet attempts that originate from the remote host 199.211.211.17.

This rule applies to Telnet packets that come from a host with the IP address 199.211.211.17. If a match occurs, the packet is blocked.

Here is what this rule looks like when implemented as a filter on the Netopia Firmware Version 5.4:

```
+--#--Source IP Addr--Dest IP Addr-----Proto--Src.Port--D.Port--On?-Fwd--+
| 1 199.211.211.17 0.0.0.0          TCP    23                Yes No  |
```

To understand this particular filter, look at the parts of a filter.

## Parts of a filter

A filter consists of criteria based on packet attributes. A typical filter can match a packet on any one of the following attributes:

- The source IP address (where the packet was sent from)
- The destination IP address (where the packet is going)
- The type of higher-layer Internet protocol the packet is carrying, such as TCP or UDP

## Port numbers

A filter can also match a packet's port number attributes, but only if the filter's protocol type is set to TCP or UDP, since only those protocols use port numbers. The filter can be configured to match the following:

- The source port number (the port on the sending host that originated the packet)
- The destination port number (the port on the receiving host that the packet is destined for)

By matching on a port number, a filter can be applied to selected TCP or UDP services, such as Telnet, FTP, and World Wide Web. The following tables show a few common services and their associated port numbers:

Internet service	TCP port	Internet service	TCP port
FTP	20/21	Finger	79
Telnet	23	World Wide Web	80
SMTP (mail)	25	News	144
Gopher	70	rlogin	513

Internet service	UDP port	Internet service	UDP port
Who Is	43	AppleTalk Routing Maintenance (at-rtmp)	202
World Wide Web	80	AppleTalk Name Binding (at-nbp)	202
SNMP	161	AURP (AppleTalk)	387
TFTP	69	who	513

## ***Port number comparisons***

A filter can also use a comparison option to evaluate a packet's source or destination port number. The comparison options are:

**No Compare:** No comparison of the port number specified in the filter with the packet's port number.

**Not Equal To:** For the filter to match, the packet's port number cannot equal the port number specified in the filter.

**Less Than:** For the filter to match, the packet's port number must be less than the port number specified in the filter.

**Less Than or Equal:** For the filter to match, the packet's port number must be less than or equal to the port number specified in the filter.

**Equal:** For the filter to match, the packet's port number must equal the port number specified in the filter.

**Greater Than:** For the filter to match, the packet's port number must be greater than the port number specified in the filter.

**Greater Than or Equal:** For the filter to match, the packet's port number must be greater than or equal to the port number specified in the filter.

## ***Other filter attributes***

There are three other attributes to each filter:

- The filter's order (i.e., priority) in the filter set
- Whether the filter is currently active
- Whether the filter is set to forward packets or to block (discard) packets

## Putting the parts together

When you display a filter set, its filters are displayed as rows in a table:

```

+---#---Source IP Addr---Dest IP Addr-----Proto--Src.Port--D.Port--On?-Fwd--+
+-----+-----+-----+-----+-----+-----+-----+-----+
1  192.211.211.17  0.0.0.0          TCP    0        23        Yes No
2  0.0.0.0          0.0.0.0          TCP    NC       =6000     Yes No
3  0.0.0.0          0.0.0.0          ICMP   --       --        Yes Yes
4  0.0.0.0          0.0.0.0          TCP    NC       >1023     Yes Yes
5  0.0.0.0          0.0.0.0          UDP    NC       >1023     Yes Yes
+-----+-----+-----+-----+-----+-----+-----+-----+

```

The table's columns correspond to each filter's attributes:

**#:** The filter's priority in the set. Filter number 1, with the highest priority, is first in the table.

**Source IP Addr:** The packet source IP address to match.

**Dest IP Addr:** The packet destination IP address to match.

**Proto:** The protocol to match. This can be entered as a number (see the table below) or as TCP or UDP if those protocols are used.

Protocol	Number to use	Full name
N/A	0	Ignores protocol type
ICMP	1	Internet Control Message Protocol
TCP	6	Transmission Control Protocol
UDP	17	User Datagram Protocol

**Src. Port:** The source port to match. This is the port on the sending host that originated the packet.

**D. Port:** The destination port to match. This is the port on the receiving host for which the packet is intended.

**On?:** Displays **Yes** when the filter is in effect or **No** when it is not.

**Fwd:** Shows whether the filter forwards (**Yes**) a packet or discards (**No**) it when there's a match.

## Filtering example #1

Returning to our filtering rule example from above (see [page 10-20](#)), look at how a rule is translated into a filter. Start with the rule, then fill in the filter's attributes:

- The rule you want to implement as a filter is:
  - Block all Telnet attempts that originate from the remote host 199.211.211.17.
- The host 199.211.211.17 is the source of the Telnet packets you want to block, while the destination address is any IP address. How these IP addresses are masked determines what the final match will be, although the mask is not displayed in the table that displays the filter sets (you set it when you create the filter). In fact, since the mask for the destination IP address is 0.0.0.0, the address for Dest IP Addr could have been anything. The mask for Source IP Addr must be 255.255.255.255 since an exact match is desired.
  - Source IP Addr = 199.211.211.17
  - Source IP address mask = 255.255.255.255
  - Dest IP Addr = 0.0.0.0
  - Destination IP address mask = 0.0.0.0
- Using the tables on [page 10-21](#), find the destination port and protocol numbers (the *local* Telnet port):
  - Proto = TCP (or 6)
  - D. Port = 23
- The filter should be enabled and instructed to block the Telnet packets containing the source address shown in step 2:
  - On? = Yes
  - Fwd = No

This four-step process is how we produced the following filter from the original rule:

+	#	Source IP Addr	Dest IP Addr	Proto	Src.Port	D.Port	On?	Fwd	+
	1	192.211.211.17	0.0.0.0	TCP	0	23	Yes	No	

## Filtering example #2

Suppose a filter is configured to block all incoming IP packets with the source IP address of 200.233.14.0, regardless of the type of connection or its destination. The filter would look like this:

+	#	Source IP Addr	Dest IP Addr	Proto	Src.Port	D.Port	On?	Fwd	+
	1	200.233.14.0	0.0.0.0		0		Yes	No	

This filter blocks any packets coming from a remote network with the IP network address 200.233.14.0. The 0 at the end of the address signifies *any* host on the class C IP network 200.233.14.0. If, for example, the filter is applied to a packet with the source IP address 200.233.14.5, it will block it.

In this case, the mask, which does not appear in the table, must be set to 255.255.255.0. This way, all packets with a source address of 200.233.14.x will be matched correctly, no matter what the final address byte is.

---

**Note:** The protocol attribute for this filter is 0 by default. This tells the filter to ignore the IP protocol or type of IP packet.

---

## Design guidelines

Careful thought must go into designing a new filter set. You should consider the following guidelines:

- Be sure the filter set's overall purpose is clear from the beginning. A vague purpose can lead to a faulty set, and that can actually make your network *less* secure.
- Be sure each individual filter's purpose is clear.
- Determine how filter priority will affect the set's actions. Test the set (on paper) by determining how the filters would respond to a number of different hypothetical packets.
- Consider the combined effect of the filters. If every filter in a set fails to match on a particular packet, the packet is:
  - Forwarded if all the filters are configured to discard (*not* forward)
  - Discarded if all the filters are configured to forward
  - Discarded if the set contains a combination of forward and discard filters

## Disadvantages of filters

Although using filter sets can greatly enhance network security, there are disadvantages:

- Filters are complex. Combining them in filter sets introduces subtle interactions, increasing the likelihood of implementation errors.
- Enabling a large number of filters can have a negative impact on performance. Processing of packets will take longer if they have to go through many checkpoints.
- Too much reliance on packet filters can cause too little reliance on other security methods. Filter sets are *not* a substitute for password protection, effective safeguarding of passwords, caller ID, the "must match" option in the answer profile, PAP or CHAP in connection profiles, callback, and general awareness of how your network may be vulnerable.

## An approach to using filters

The ultimate goal of network security is to prevent unauthorized access to the network without compromising authorized access. Using filter sets is part of reaching that goal.

Each filter set you design will be based on one of the following approaches:

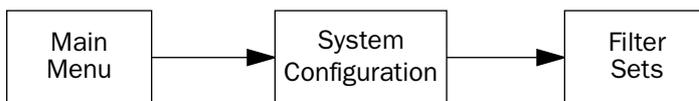
- That which is not expressly prohibited is permitted.
- That which is not expressly permitted is prohibited.

It is strongly recommended that you take the latter, and safer, approach to all of your filter set designs.

---

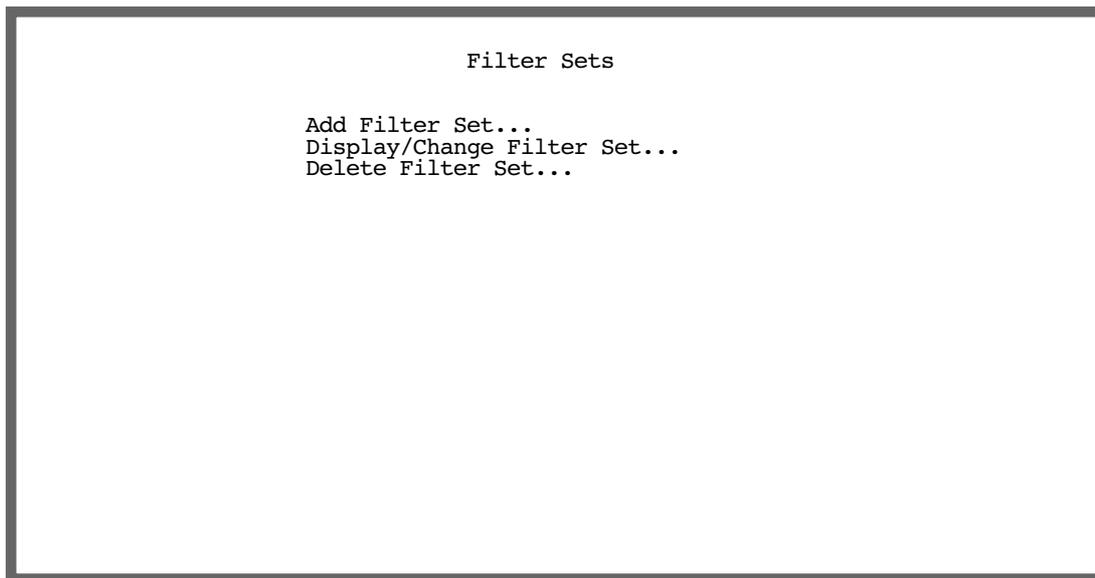
## Working with IP Filters and Filter Sets

This section covers IP filters and filter sets.



To work with filters and filter sets, begin by accessing the filter set screens.

**Note:** Make sure you understand how filters work before attempting to use them. Read the section “[About Filters and Filter Sets,](#)” beginning on page 10-18.



The procedure for creating and maintaining filter sets is as follows:

1. Add a new filter set.
2. Create the filters for the new filter set.

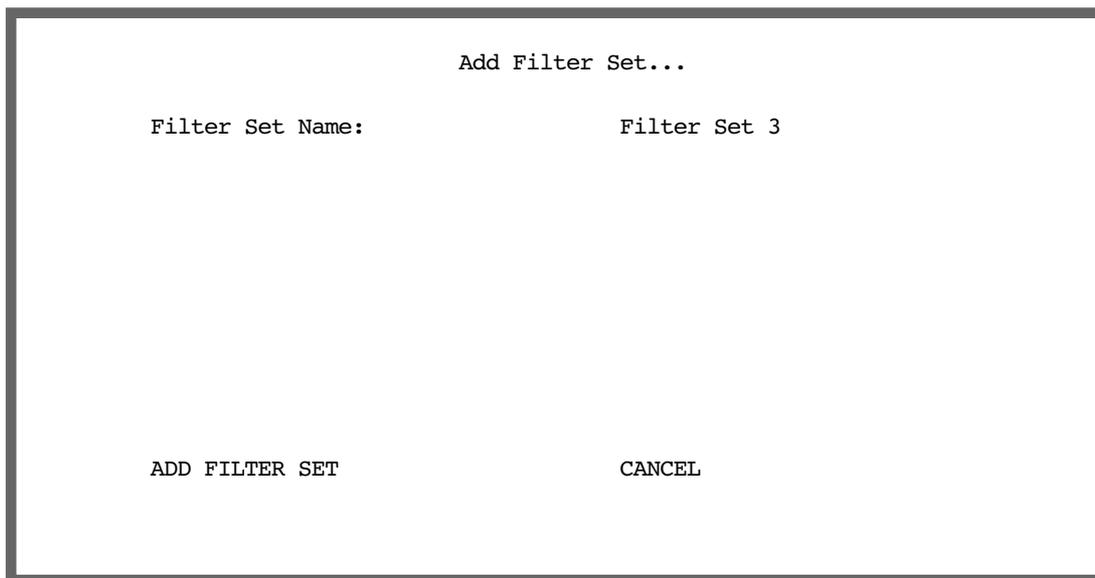
3. View, change, or delete individual filters and filter sets.

The sections below explain how to execute these steps.

## Adding a filter set

You can create up to eight different custom filter sets. Each filter set can contain up to 16 output filters and up to 16 input filters.

To add a new filter set, select **Add Filter Set** in the Filter Sets screen and press Return. The Add Filter Set screen appears.



Add Filter Set...

Filter Set Name: Filter Set 3

ADD FILTER SET CANCEL

### *Naming a new filter set*

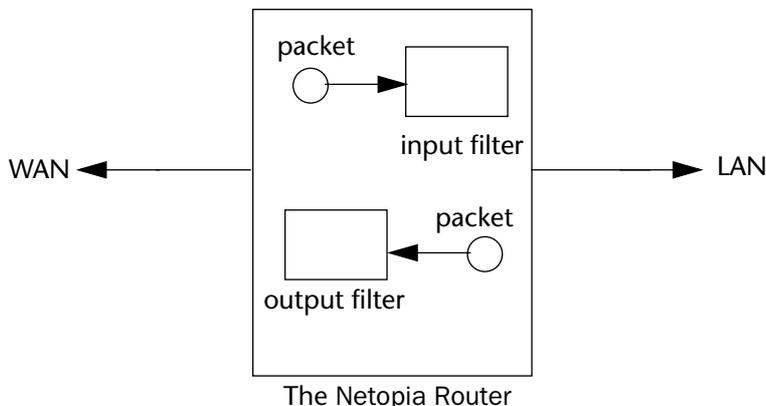
All new filter sets have a default name. The first filter set you add will be called Filter Set 1, the next filter will be Filter Set 2, and so on.

To give a new filter set a different name, select **Filter Set Name** and enter a new name for the filter set.

To save the filter set, select **ADD FILTER SET**. The saved filter set is empty (contains no filters), but you can return to it later to add filters (see [“Adding filters to a filter set” on page 10-28](#)).

## Adding filters to a filter set

There are two kinds of filters you can add to a filter set: input and output. Input filters check packets received from the Internet, destined for your network. Output filters check packets transmitted from your network to the Internet.

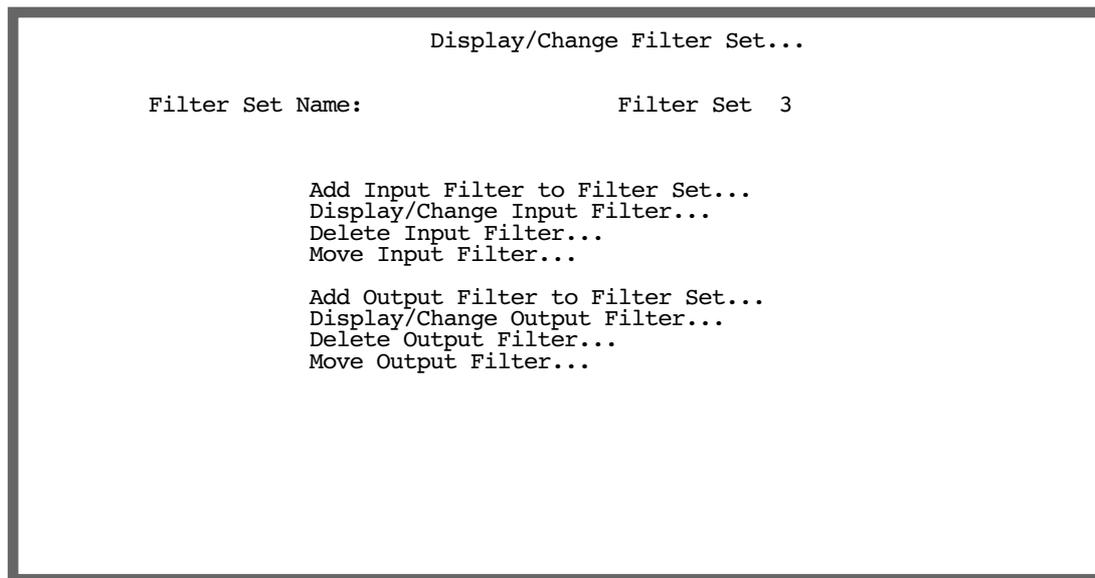


*Packets in the Netopia Firmware Version 5.4 pass through an input filter if they originate in the WAN and through an output filter if they're being sent out to the WAN.*

The process for adding input and output filters is exactly the same. The main difference between the two involves their reference to source and destination. From the perspective of an input filter, your local network is the destination of the packets it checks, and the remote network is their source. From the perspective of an output filter, your local network is the source of the packets, and the remote network is their destination.

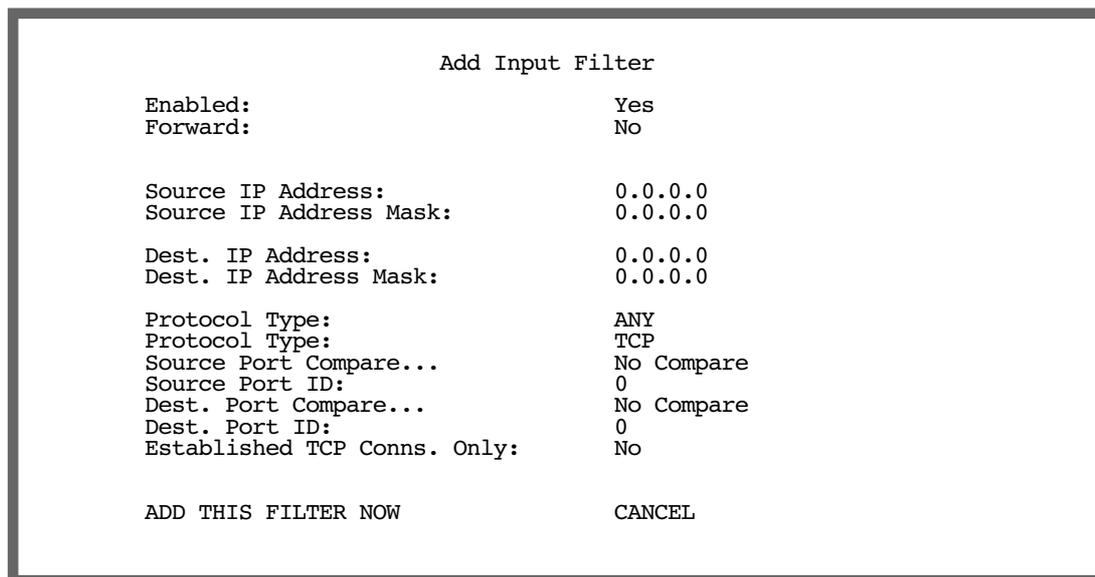
Type of filter	Source means	Destination means
Input filter	The remote network	The local network
Output filter	The local network	The remote network

To add a filter, select **Display/Change Filter Set** in the Filter Set screen. From the pop-up menu, select the filter set to which you will add a filter. The Display/Change Filter Set screen appears.



**Note:** There are two groups of items in this screen, one for input filters and one for output filters. In this section, you'll learn how to add an input filter to a filter set. Adding an output filter works exactly the same way, providing you keep the different source and destination perspectives in mind.

1. To add a filter, select **Add Input Filter to Filter Set** and press Return. The Add Input Filter screen appears.



2. To make the filter active in the filter set, select **Enabled** and toggle it to **Yes**. If **Enabled** is toggled to **No**, the filter can still exist in the filter set, but it will have no effect.

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3. If you want the filter to forward packets that match its criteria to the destination IP address, select **Forward** and toggle it to **Yes**. If **Forward** is toggled to **No**, packets matching the filter's criteria will be discarded.
  4. Select **Source IP Address** and enter the source IP address this filter will match on. You can enter a subnet or a host address.
  5. Select **Source IP Address Mask** and enter a mask for the source IP address. This allows you to further modify the way the filter will match on the source address. Enter 0.0.0.0 to force the filter to match on all source IP addresses, or enter 255.255.255.255 to match the source IP address exclusively.
  6. Select **Dest. IP Address** and enter the destination IP address this filter will match on. You can enter a subnet or a host address.
  7. Select **Dest. IP Address Mask** and enter a mask for the destination IP address. This allows you to further modify the way the filter will match on the destination address. Enter 0.0.0.0 to force the filter to match on all destination IP addresses.
  8. Select **Protocol Type** and enter **ICMP, TCP, UDP, Any**, or the number of another IP transport protocol (see the table on [page 10-23](#)).
- Note:** If Protocol Type is set to TCP or UDP, the settings for port comparison that you configure in steps 8 and 9 will appear. These settings only take effect if the Protocol Type is TCP or UDP.
9. Select **Source Port Compare** and choose a comparison method for the filter to use on a packet's source port number. Then select **Source Port ID** and enter the actual source port number to match on (see the table on [page 10-21](#)).
  10. Select **Dest. Port Compare** and choose a comparison method for the filter to use on a packet's destination port number. Then select **Dest. Port ID** and enter the actual destination port number to match on (see the table on [page 10-21](#)).
  11. When you are finished configuring the filter, select **ADD THIS FILTER NOW** to save the filter in the filter set. Select **CANCEL** to discard the filter and return to the Add IP Filter Set screen.

### Viewing filters

To display a table of input or output filters, select **Display/Change Input Filter** or **Display/Change Output Filter** in the Display/Change Filter Set screen.

### Modifying filters

To modify a filter, select **Display/Change Input Filter** or **Display/Change Output Filter** in the Display/Change Filter Set screen. Select a filter from the table and press Return. The Change Filter screen appears. The parameters in this screen are set in the same way as the ones in the Add Filter screen (see [“Adding filters to a filter set” on page 10-28](#)).

Change Filter	
Enabled:	No
Forward:	No
Source IP Address:	0.0.0.0
Source IP Address Mask:	0.0.0.0
Dest. IP Address:	0.0.0.0
Dest. IP Address Mask:	0.0.0.0
Protocol Type:	0
Source Port Compare...	No Compare
Source Port ID:	0
Dest. Port Compare...	No Compare
Dest. Port ID:	0

Enter the IP specific information for this filter.

## Deleting filters

To delete a filter, select **Delete Input Filter** or **Delete Output Filter** in the Display/Change Filter Set screen to display a table of filters.

Select the filter from the table and press Return to delete it. Press Escape to exit the table without deleting the filter.

## Moving filters

To reorganize the filters in a filter set, select **Move Input Filter** or **Move Output Filter** in the Display/Change Filter Set screen to display a table of filters.

Select a filter from the table and press Return. Then use the up or down arrow key to change the filter's order in the filter set. Press Return to accept the new filter location.

## Deleting a filter set

**Note:** If you delete a filter set, all of the filters it contains are deleted as well. To reuse any of these filters in another set, before deleting the current filter set you'll have to note their configuration and then recreate them.

To delete a filter set, select **Delete Filter Set** in the Filter Sets screen to display a list of filter sets.

Select a filter set from the list and press Return. Select CONTINUE and press Return to delete it.

## A sample filter set

This section contains the settings for a filter set called Basic Firewall, which is part of the Netopia Firmware Version 5.4's factory configuration.

## 10-32 Firmware User Guide

Basic Firewall blocks undesirable traffic originating from the WAN (in most cases, the Internet), but forwards all traffic originating from the LAN. It follows the conservative “that which is not expressly permitted is prohibited” approach: unless an incoming packet expressly matches one of the constituent input filters, it will not be forwarded to the LAN.

The five input filters and one output filter that make up Basic Firewall are shown in the table below.

Setting	Input filter 1	Input filter 2	Input filter 3	Input filter 4	Input filter 5	Output filter 1
Enabled	Yes	Yes	Yes	Yes	Yes	Yes
Forward	No	No	Yes	Yes	Yes	Yes
Source IP address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Source IP address mask	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Dest. IP address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Dest. IP address mask	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Protocol type	TCP	TCP	ICMP	TCP	UDP	0
Source port comparison	No Compare	No Compare	N/A	No Compare	No Compare	N/A
Source port ID	0	0	N/A	0	0	N/A
Dest. port comparison	Equal	Equal	N/A	Greater Than	Greater Than	N/A
Dest. port ID	2000	6000	N/A	1023	1023	N/A

Basic Firewall’s filters play the following roles.

**Input filters 1 and 2:** These block WAN-originated OpenWindows and X-Windows sessions. Service origination requests for these protocols use ports 2000 and 6000, respectively. Since these are greater than 1023, OpenWindows and X-Windows traffic would otherwise be allowed by input filter 4. Input filters 1 and 2 must precede input filter 4; otherwise they would have no effect since filter 4 would have already forwarded OpenWindows and X-Windows traffic.

**Input filter 3:** This filter explicitly forwards all WAN-originated ICMP traffic to permit devices on the WAN to ping devices on the LAN. Ping is an Internet service that is useful for diagnostic purposes.

**Input filters 4 and 5:** These filters forward all TCP and UDP traffic, respectively, when the destination port is greater than 1023. This type of traffic generally does not allow a remote host to connect to the LAN using one of the potentially intrusive Internet services, such as Telnet, FTP, and WWW.

**Output filter 1:** This filter forwards all outgoing traffic to make sure that no outgoing connections from the LAN are blocked.

Basic Firewall is suitable for a LAN containing only client hosts that want to access servers on the WAN, but not for a LAN containing servers providing services to clients on the WAN. Basic Firewall's general strategy is to explicitly forward WAN-originated TCP and UDP traffic to ports greater than 1023. Ports lower than 1024 are the service origination ports for various Internet services such as FTP, Telnet, and the World Wide Web (WWW).

A more complicated filter set would be required to provide WAN access to a LAN-based server. See the next section, "[Possible modifications](#)," for ways to allow remote hosts to use services provided by servers on the LAN.

## ***Possible modifications***

You can modify the sample filter set Basic Firewall to allow incoming traffic using the examples below. These modifications are not intended to be combined. Each modification is to be the only one used with Basic Firewall.

The results of combining filter set modifications can be difficult to predict. It is recommended that you take special care if you are making more than one modification to the sample filter set.

**Trusted host.** To allow unlimited access by a trusted remote host with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: 255.255.255.255
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: 0

**Trusted subnet.** To allow unlimited access by a trusted remote subnet with subnet address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.0) and subnet mask e.f.g.h (corresponding to a numbered IP mask such as 255.255.255.0), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: e.f.g.h
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: 0

**FTP sessions.** To allow WAN-originated FTP sessions to a LAN-based FTP server with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: 0.0.0.0
- Source IP Address Mask: 0.0.0.0
- Dest. IP Address: a.b.c.d
- Dest. IP Address Mask: 255.255.255.255
- Protocol Type: TCP
- Source Port Comparison: No Compare
- Source Port ID: 0
- Dest. Port Comparison: Equal
- Dest. Port ID: 21

---

**Note:** A similar filter could be used to permit Telnet or WWW access. Set the Dest. Port ID to 23 for Telnet or to 80 for WWW.

---

**Note:** Deleting a filter set does not delete the filters in that set. However, the filters in the deleted set are no longer in effect (unless they are part of another set). The deleted set will no longer appear in the answer profile or any connection profiles to which it was added.

---

---

## Policy-based Routing using Filtersets

Previous firmware versions routed IP packets only by destination IP address. Netopia Firmware Version 5.4 offers the ability to route IP packets using criteria other than the destination IP address. This is called *policy-based routing*. You are now able to route IP traffic based on the following:

- source IP address
- source and/or destination protocol field
- source and/or destination port numbers
- TOS field

You specify the routing criteria and routing information by using IP filtersets to determine the forwarding action of a particular filter.

In previous firmware versions, a filter would either *pass* or *block* the specified traffic. Netopia Firmware Version 5.4 adds a third option, *force routing*. You specify a gateway IP address, and each packet matching the filter is routed according to that gateway address, rather than by means of the global routing table.

In addition, the TOS field has been added to the classifier list in a filter. This allows you to filter on TOS field settings in the IP packet, if you desire.

The new filterset screen appears as follows:

```

Change Input Filter 1
Enabled:                Yes
Forward:                Yes
Call Placement/Idle Reset: No Change
Force Routing:          Yes
Gateway IP Address:     163.176.8.134
Source IP Address:      0.0.0.0
Source IP Address Mask: 0.0.0.0
Dest. IP Address:       0.0.0.0
Dest. IP Address Mask: 0.0.0.0
TOS:                    0
TOS Mask:               0
Protocol Type:          UDP
Source Port Compare...  Equal
Source Port ID:         137
Dest. Port Compare...   No Compare
Dest. Port ID:          0

Return/Enter to set comparison of packet Port ID and Filter Port ID.
Enter the packet specific information for this filter.

```

To use the policy-based routing feature, you create a filter that forwards the traffic.

- Toggle **Forward** to **Yes**. This will display the Force Routing options.
- Toggle **Force Routing** to **Yes**.
- Enter the **Gateway IP Address** in standard dotted-quad notation to which the traffic should be forwarded.
- You can enter **Source** and **Destination IP Address(es)** and **Mask(s)**, **Protocol Type**, and **Source** and **Destination Port ID(s)** for the filter, if desired.

## TOS field matching

Netopia Firmware Version 5.4 adds two additional new parameters to an IP filter: **TOS** and **TOS Mask**. Both fields accept values in the range 0 – 255.

Certain types of IP packets, such as voice or multimedia packets, are sensitive to latency introduced by the network. A delay-sensitive packet is one that has the low-latency bit set in the TOS field of the IP header. This means that if such packets are not received rapidly, the quality of service degrades. If you expect to route significant amounts of such traffic you can configure your router to route this type of traffic to a gateway other than your normal gateway using this feature.

The TOS field matching check is consistent with source and destination address matching.

**Example:** You want packets with the TOS low latency bit to go through VC 2 (via gateway 127.0.0.3) instead of your normal gateway. You would set up the filter as follows:

```

                                Add Input Filter
Enabled:                          Yes
Forward:                          Yes
Call Placement/Idle Reset:        No Change
Force Routing:                     Yes
Gateway IP Address:                127.0.0.3

Source IP Address:                 0.0.0.0
Source IP Address Mask:            0.0.0.0
Dest. IP Address:                  0.0.0.0
Dest. IP Address Mask:             0.0.0.0
TOS:                               16
TOS Mask:                          16
Protocol Type:                     ANY

                                ADD THIS FILTER NOW          CANCEL

Return/Enter to add this Filter to the Filter Set.
Enter the packet specific information for this filter.
```

**Note:****Default Forwarding Filter**

If you create one or more filters that have a matching action of *forward*, then action on a packet matching *none* of the filters is to block any traffic.

Therefore, if the behavior you want is to force the routing of a certain type of packet and pass all others through the normal routing mechanism, you must configure one filter to match the first type of packet and apply Force Routing. A subsequent filter is required to match and forward all other packets.

**Management IP traffic**

If the Force Routing filter is applied to source IP addresses, it may inadvertently block communication with the router itself. You can avoid this by preceding the Force Routing filter with a filter that matches the destination IP address of the router itself.

---

# Firewall Tutorial

## General firewall terms

**Filter rule:** A filter set is comprised of individual filter rules.

**Filter set:** A grouping of individual filter rules.

**Firewall:** A component or set of components that restrict access between a protected network and the Internet, or between two networks.

**Host:** A workstation on the network.

**Packet:** Unit of communication on the Internet.

**Packet filter:** Packet filters allow or deny packets based on source or destination IP addresses, TCP or UDP ports, or the TCP ACK bit.

**Port:** A number that defines a particular type of service.

## Basic IP packet components

All IP packets contain the same basic header information, as follows:

Source IP Address	163.176.132.18
Destination IP Address	163.176.4.27
Source Port	2541
Destination Port	80
Protocol	TCP
ACK Bit	Yes
DATA	User Data

This header information is what the packet filter uses to make filtering decisions. It is important to note that a packet filter does not look into the IP data stream (the User Data from above) to make filtering decisions.

## Basic protocol types

**TCP:** Transmission Control Protocol. TCP provides reliable packet delivery and has a retransmission mechanism (so packets are not lost). RFC 793 is the specification for TCP.

**UDP:** User Datagram Protocol. Unlike TCP, UDP does not guarantee reliable, sequenced packet delivery. If data does not reach its destination, UDP does not retransmit the data. RFC 768 is the specification for UDP.

There are many more ports defined in the Assigned Addresses RFC. The table that follows shows some of these port assignments.

**Example TCP/UDP Ports**

TCP Port	Service	UDP Port	Service
20/21	FTP	161	SNMP
23	Telnet	69	TFTP
25	SMTP	387	AURP
80	WWW		
144	News		

**Firewall design rules**

There are two basic rules to firewall design:

- “What is not explicitly allowed is denied.”

and

- “What is not explicitly denied is allowed.”

The first rule is far more secure, and is the best approach to firewall design. It is far easier (and more secure) to allow in or out only certain services and deny anything else. If the other rule is used, you would have to figure out everything that you want to disallow, now and in the future.

**Firewall Logic**

Firewall design is a test of logic, and filter rule ordering is critical. If a packet is forwarded through a series of filter rules and then the packet matches a rule, the appropriate action is taken. The packet will not forward through the remainder of the filter rules.

For example, if you had the following filter set...

Allow WWW access;

Allow FTP access;

Allow SMTP access;

Deny all other packets.

and a packet goes through these rules destined for FTP, the packet would forward through the first rule (WWW), go through the second rule (FTP), and match this rule; the packet is allowed through.

If you had this filter set for example....

Allow WWW access;

Allow FTP access;

Deny FTP access;

Deny all other packets.

and a packet goes through these rules destined for FTP, the packet would forward through the first filter rule (WWW), match the second rule (FTP), and the packet is allowed through. Even though the next rule is to deny all FTP traffic, the FTP packet will never make it to this rule.

## Binary representation

It is easiest when doing filtering to convert the IP address and mask in question to binary. This will allow you to perform the logical AND to determine whether a packet matches a filter rule.

## Logical AND function

When a packet is compared (in most cases) a logical AND function is performed. First the IP addresses and subnet masks are converted to binary and then combined with AND. The rules for the logical use of AND are as follows:

$$0 \text{ AND } 0 = 0$$

$$0 \text{ AND } 1 = 0$$

$$1 \text{ AND } 0 = 0$$

$$1 \text{ AND } 1 = 1$$

For example:

Filter rule:

Deny

IP: 163.176.1.15                      BINARY:                      10100011.10110000.00000001.00001111

Mask: 255.255.255.255              BINARY:                      11111111.11111111.11111111.11111111

Incoming Packet:

IP 163.176.1.15                      BINARY:                      10100011.10110000.00000001.00001111

If you put the incoming packet and subnet mask together with AND, the result is:

10100011.10110000.00000001.00001111

which matches the IP address in the filter rule and the packet is denied.

## Implied rules

With a given set of filter rules, there is an Implied rule that may or may not be shown to the user. The implied rule tells the filter set what to do with a packet that does not match any of the filter rules. An example of implied rules is as follows:

Implied	Meaning
Y+Y+Y=N	If all filter rules are YES, the implied rule is NO.
N+N+N=Y	If all filter rules are NO, the implied rule is YES.
Y+N+Y=N	If a mix of YES and NO filters, the implied rule is NO.

## Established connections

The TCP header contains one bit called the ACK bit (or TCP Ack bit). This ACK bit appears only with TCP, not UDP. The ACK bit is part of the TCP mechanism that guarantees the delivery of data. The ACK bit is set whenever one side of a connection has received data from the other side. Only the first TCP packet will not have the ACK bit set; once the TCP connection is in place, the remainder of the TCP packets will have the ACK bit set.

The ACK bit is helpful for firewall design and reduces the number of potential filter rules. A filter rule could be created just allowing incoming TCP packets with the ACK bit set, since these packets had to be originated from the local network.

## Example filter set screen

This is an example of the Netopia filter set screen:

```

Change Input Filter 1

Enabled:                               Yes
Forward:                               No

Source IP Address:                     0.0.0.0
Source IP Address Mask:                0.0.0.0

Dest. IP Address:                      0.0.0.0
Dest. IP Address Mask:                0.0.0.0

Protocol Type:                         TCP
Source Port Compare...                 No Compare
Source Port ID:                       0
Dest. Port Compare...                 Equal
Dest. Port ID:                         2000
Established TCP Conns. Only:          No

```

## Filter basics

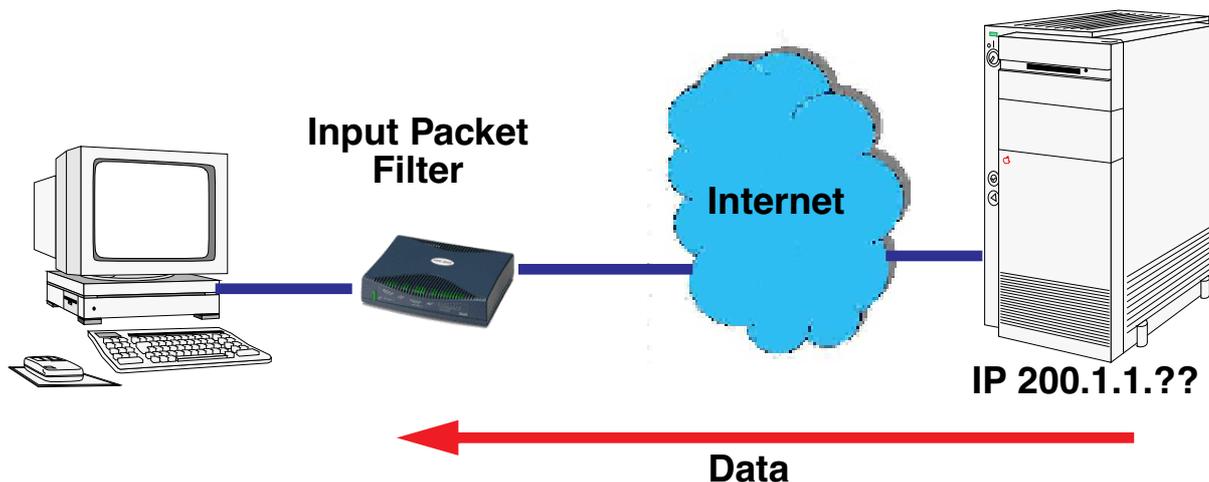
In the source or destination IP address fields, the IP address that is entered must be the network address of the subnet. A host address can be entered, but the applied subnet mask must be 32 bits (255.255.255.255).

The Netopia Firmware Version 5.4 has the ability to compare source and destination TCP or UDP ports. These options are as follows:

Item	What it means
No Compare	Does not compare TCP or UDP port
Not Equal To	Matches any port other than what is defined
Less Than	Anything less than the port defined

Less Than or Equal	Any port less than or equal to the port defined
Equal	Matches only the port defined
Greater Than or Equal	Matches the port or any port greater
Greater Than	Matches anything greater than the port defined

### Example network



### Example filters

#### Example 1

Filter Rule:	200.1.1.0	(Source IP Network Address)
	255.255.255.128	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.28

IP Address	Binary Representation	
200.1.1.28	00011100	(Source address in incoming IP packet)
AND		
255.255.255.128	10000000	(Perform the logical AND)

	00000000	(Logical AND result)
--	----------	----------------------

This incoming IP packet has a source IP address that matches the network address in the Source IP Address field (00000000) in the Netopia Firmware Version 5.4. This will *not* forward this packet.

### Example 2

Filter Rule:	200.1.1.0	(Source IP Network Address)
	255.255.255.128	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.184.

IP Address	Binary Representation	
200.1.1.184	10111000	(Source address in incoming IP packet)
AND		
255.255.255.128	10000000	(Perform the logical AND)
	10000000	(Logical AND result)

This incoming IP packet (10000000) has a source IP address that does not match the network address in the Source IP Address field (00000000) in the Netopia Firmware Version 5.4. This rule *will* forward this packet because the packet does not match.

### Example 3

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.240	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.184.

IP Address	Binary Representation	
200.1.1.184	10111000	(Source address in incoming IP packet)
AND		

255.255.255.240	11110000	(Perform the logical AND)
	10110000	(Logical AND result)

Since the Source IP Network Address in the Router is 01100000, and the source IP address after the logical AND is 1011000, this rule does *not* match and this packet will be forwarded.

### Example 4

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.240	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.104.

IP Address	Binary Representation	
200.1.1.104	01101000	(Source address in incoming IP packet)
AND		
255.255.255.240	11110000	(Perform the logical AND)
	01100000	(Logical AND result)

Since the Source IP Network Address in the Router is 01100000, and the source IP address after the logical AND is 01100000, this rule *does* match and this packet will *not* be forwarded.

### Example 5

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.255	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.96.

IP Address	Binary Representation	
200.1.1.96	01100000	(Source address in incoming IP packet)
AND		

255.255.255.255	11111111	(Perform the logical AND)
	01100000	(Logical AND result)

Since the Source IP Network Address in the Router is 01100000, and the source IP address after the logical AND is 01100000, this rule *does* match and this packet will *not* be forwarded. This rule masks off a *single* IP address.

## Configuration Management

Netopia Firmware Version 5.4 offers a Configuration Management feature. Configuration Management provides a way to store several router configurations in a single device for use at different times. This feature is supported on all models that support the version 5.4 firmware except the 4752 IAD.

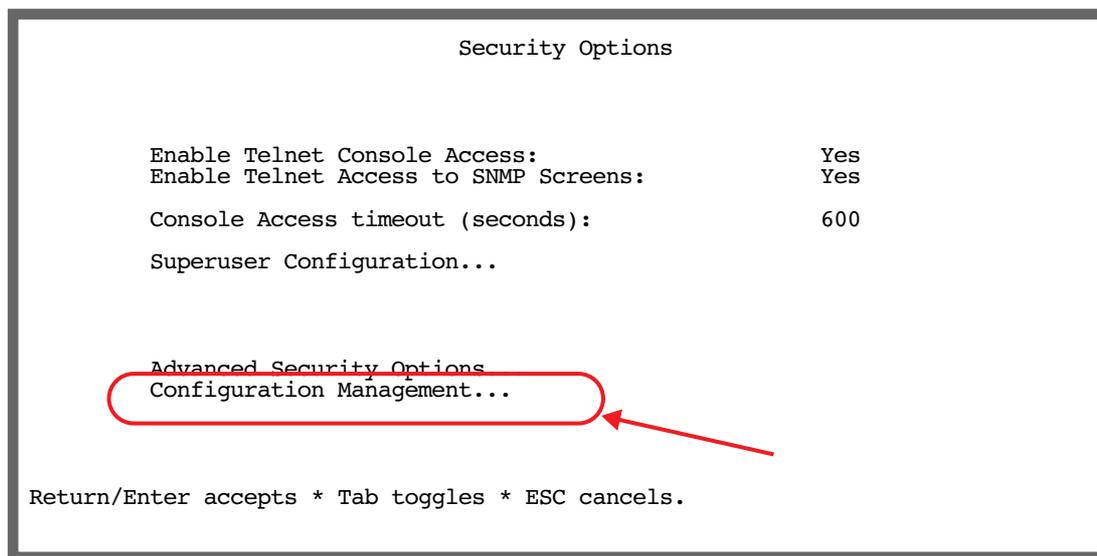
You can store up to three configurations in the router's memory in addition to the currently running configuration. The current configuration is the one currently booted from and is updated whenever there is a change to the router (logged events, parameter changes).

Other configurations are stored along with the current configuration. Whenever you choose, you can reboot into one of these configurations (the copy of which becomes the current configuration).

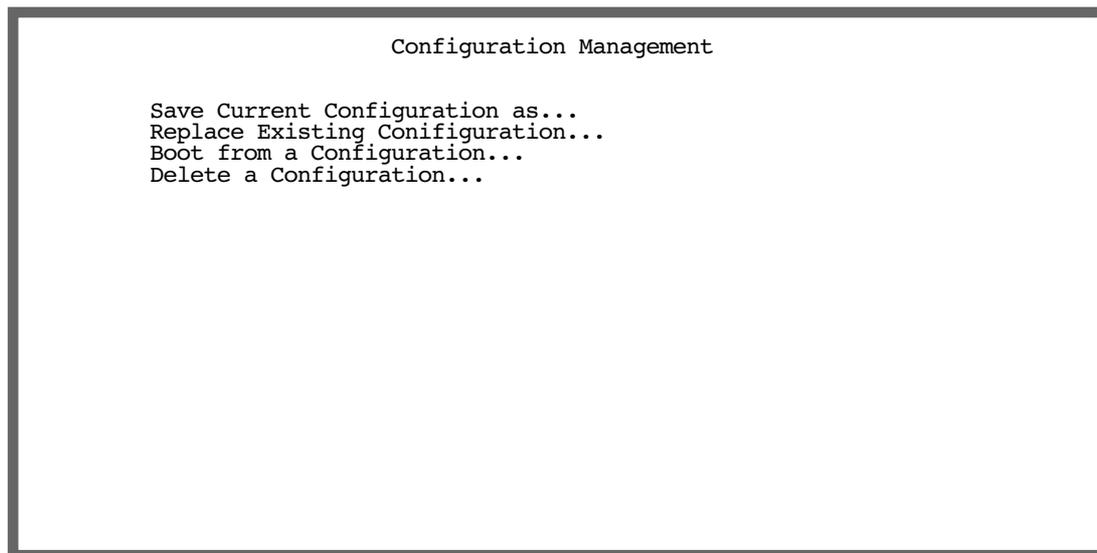
You name the saved configurations, giving you a reference for identifying each one. The naming operation occurs when you decide to save a configuration or when downloading a configuration via TFTP or X-Modem.

The configurations that are saved will persist across a Factory Default (soft or NMI). The router will reboot with a Factory Defaulted configuration, as usual, but the saved configurations are still available for use.

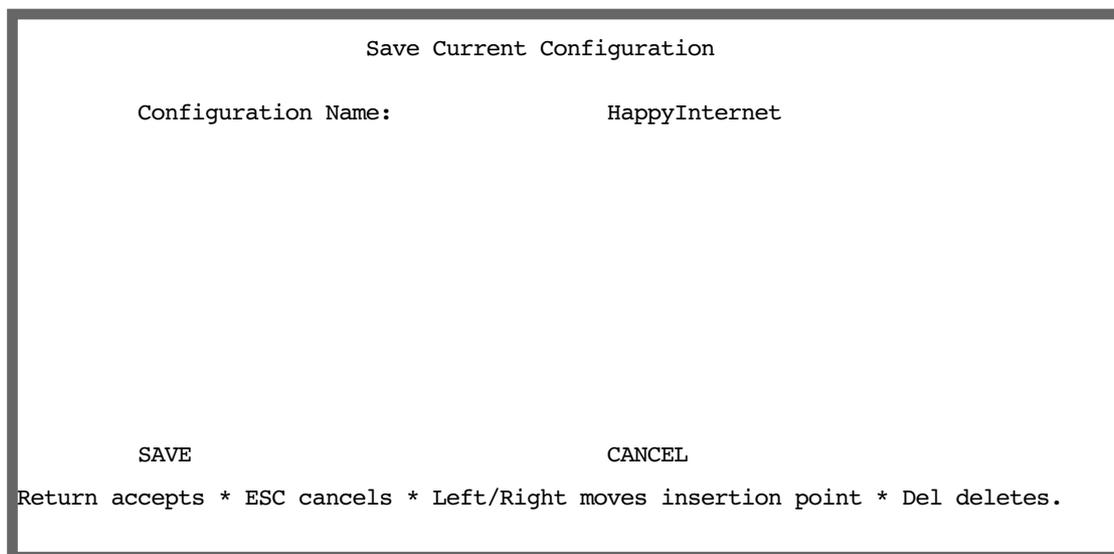
You save your configurations in the Configuration Management screen in the Security menus.



Select **Configuration Management**, and press Return. The Configuration Management screen appears.

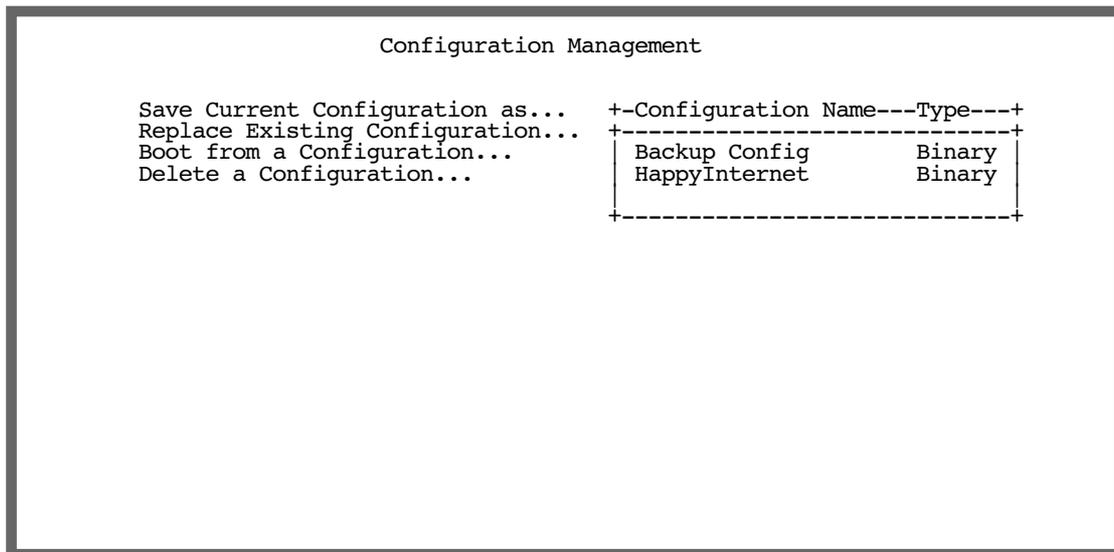


Select **Save Current Configuration as**, and press Return. The Save Current Configuration screen appears.



Enter a descriptive name for your current configuration, select **SAVE**, and press Return. Your configuration will be saved to the flash memory, and you will be returned to the Configuration Management screen.

If you choose to run one of your stored configurations, you can select it from a pop-up menu. If you select **Boot from a Configuration** and select a different one, you can reboot the router with your selected configuration.



A warning screen will ask you to confirm your choice.

## TFTP and X-Modem

You can also send or receive your stored configuration files via TFTP or X-Modem. You select the stored configuration files from pull-down menus in the TFTP or X-Modem File Transfer screens in the Utilities & Diagnostics menu, as shown.

### TFTP

```

Trivial File Transfer Protocol (TFTP)

TFTP Server Name:
Firmware File Name:
GET ROUTER FIRMWARE FROM SERVER...

Config File Name: +-----+
Get Configuration Destination... | Current Configuration
GET CONFIG FROM SERVER...      | Backup Config
                               | HappyInternet
Send Configuration...          | <Empty> Type Name
SEND CONFIG TO SERVER...      +-----+

TFTP Transfer State -- Idle
TFTP Current Transfer Bytes -- 0

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

### X-Modem

```

X-Modem File Transfer

Send Firmware to Netopia... +-----+
Get Configuration Destination... | Current Configuration
Send Config to Netopia...      | Backup Config
                               | HappyInternet
Send Configuration...          | <Empty> Type Name
Receive Config from Netopia... +-----+

Up/Down Arrow Keys to select, ESC to dismiss, Return/Enter to Edit.

```

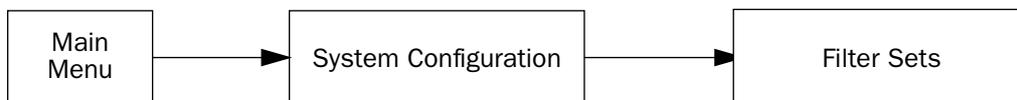
## Call Filtering

Netopia Firmware Version 5.4 supports a call filtering mechanism that lets you control which packets cause connections to be established and which packets cause connections to be maintained (that is, to not time out due to inactivity). This feature is part of the Filter Set management component of the firmware. Call filtering makes use of the existing sets of filter rules that can be associated with a connection.

The term *connection* includes both non-VPN connection profiles for which the remote network is reached through a switched WAN interface, such as Analog or ISDN, and all VPN connection profiles, such as ATMP, PPTP, and IPsec.

The call filtering mechanism is useful if you have a time-limited type of connection. Such a connection may time out during a period of inactivity and may you want it to be re-established or maintained automatically for certain types of traffic.

You manage Filters and Filter Sets in the Filter Sets management screen under the System Configuration menus.



The Add Output Filter menu appears as follows:

Add Output Filter	
Enabled:	Yes
Forward:	Yes
Source IP Address:	0.0.0.0
Source IP Address Mask:	0.0.0.0
Dest. IP Address:	0.0.0.0
Dest. IP Address Mask:	0.0.0.0
Protocol Type:	ANY
ADD THIS FILTER NOW	CANCEL
Return/Enter accepts * Tab toggles * ESC cancels. Enter the packet specific information for this filter.	

When you add (or change) an output filter, and toggle **Forward** to **Yes**, a new **Call Placement/Idle Reset** pop-up menu becomes visible.

Add Output Filter	
Enabled:	+-----+
Forward:	+-----+
Call Placement/Idle Reset:	No Change Disabled
Source IP Address:	0.0.0.0
Source IP Address Mask:	0.0.0.0
Dest. IP Address:	0.0.0.0
Dest. IP Address Mask:	0.0.0.0
Protocol Type:	ANY
ADD THIS FILTER NOW	CANCEL

This pop-up menu allows you to configure what action will be taken for packets that the filter rule specifies should be forwarded.

- If you set **Call Placement/Idle Reset** to **No Change** (the default), no change will be made to the call filtering attribute associated with the packet. If no other filter rule with its Call Placement/Idle Reset pop-up set to Disabled previously has been or subsequently will be applied to the packet, the packet will be forwarded as usual. No special action will be taken.

If the connection is up, the connection's idle timer will be refreshed and the packet forwarded as usual. If the connection is down, the packet is queued until a connection is established.

- If you set the **Call Placement/Idle Reset** to **Disabled**, the call filtering attribute associated with the packet will be set such that the packet will be dropped if the connection is down, and forwarded without resetting the idle timer if the connection is up.



# Chapter 11

## Utilities and Diagnostics

A number of utilities and tests are available for system diagnostic and control purposes.

This section covers the following topics:

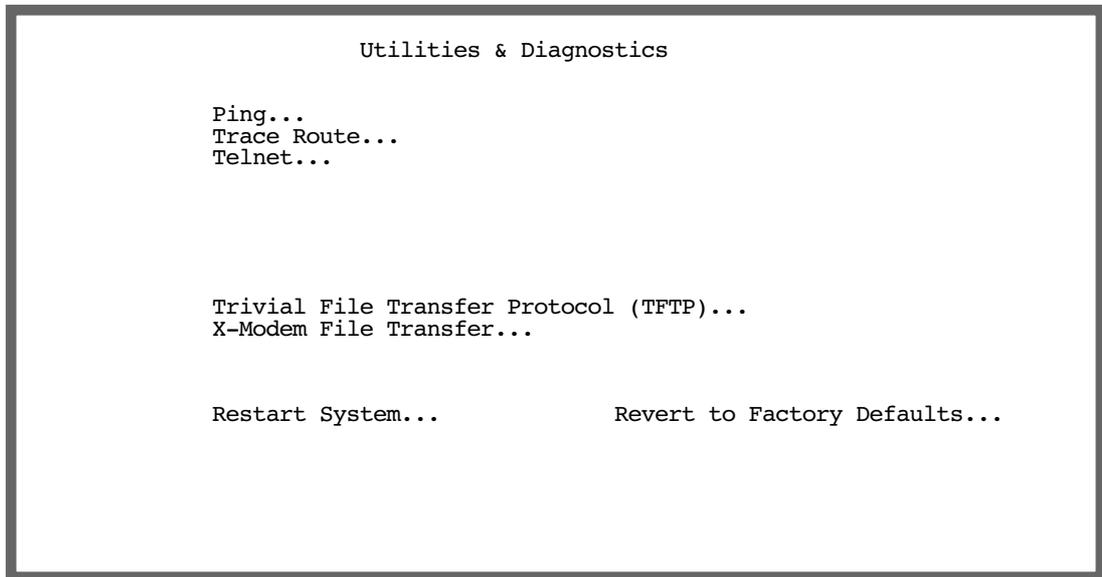
- “Ping” on page 11-2
- “Trace Route” on page 11-4
- “Telnet Client” on page 11-5
- “Factory Defaults” on page 11-6
- “Transferring Configuration and Firmware Files with TFTP” on page 11-6
- “Transferring Configuration and Firmware Files with XMODEM” on page 11-9
- “Restarting the System” on page 11-12
- “T1 Line Statistics and Diagnostics” on page 11-12

---

**Note:** These utilities and tests are accessible only through the console-based management screens. See the *Getting Started Guide* chapter, “Console-Based Management,” for information on accessing the console-based management screens.

---

You access the Utilities & Diagnostics screens from the Main Menu.



## Ping

The Netopia Firmware Version 5.4 Router includes a standard Ping test utility. A Ping test generates IP packets destined for a particular (Ping-capable) IP host. Each time the target host receives a Ping packet, it returns a packet to the original sender.

Ping allows you to see whether a particular IP destination is reachable from the Router. You can also ascertain the quality and reliability of the connection to the desired destination by studying the Ping test's statistics.

In the Utilities & Diagnostic screen, select **Ping** and press Return. The ICMP Ping screen appears.

```

                                ICMP Ping

Name of Host to Ping:
Packets to Send:                5
Data Size:                      56
Delay (seconds):                1

                                START PING

Status:

Packets Out:                    0
Packets In:                     0
Packets Lost:                   0 (0%)
Round Trip Time
  (Min/Max/Avg):                0.000 / 0.000 / 0.000 secs

Enter the IP Address/Domain Name of a host to ping.
Send ICMP Echo Requests to a network host.

```

To configure and initiate a Ping test, follow these steps:

1. Select **Name of Host to Ping** and enter the destination domain name or IP address.
2. Select **Packets to Send** to change the default setting. This is the total number of packets to be sent during the Ping test. The default setting is adequate in most cases, but you can change it to any value from 1 to 4,294,967,295.
3. Select **Data Size** to change the default setting. This is the size, in bytes, of each Ping packet sent. The default setting is adequate in most cases, but you can change it to any value from 0 (only header data) to 1664.
4. Select **Delay (seconds)** to change the default setting. The delay, in seconds, determines the time between Ping packets sent. The default setting is adequate in most cases, but you can change it to any value from 0 to 4,294,967. A delay of 0 seconds forces packets to be sent immediately, one after another.
5. Select **START PING** and press Return to begin the Ping test. While the test is running, the **START PING** item becomes **STOP PING**. To manually stop the Ping test, select **STOP PING** and press Return or Escape.

While the Ping test is running and when it is over, a status field and a number of statistical items are active on the screen. These are described below.

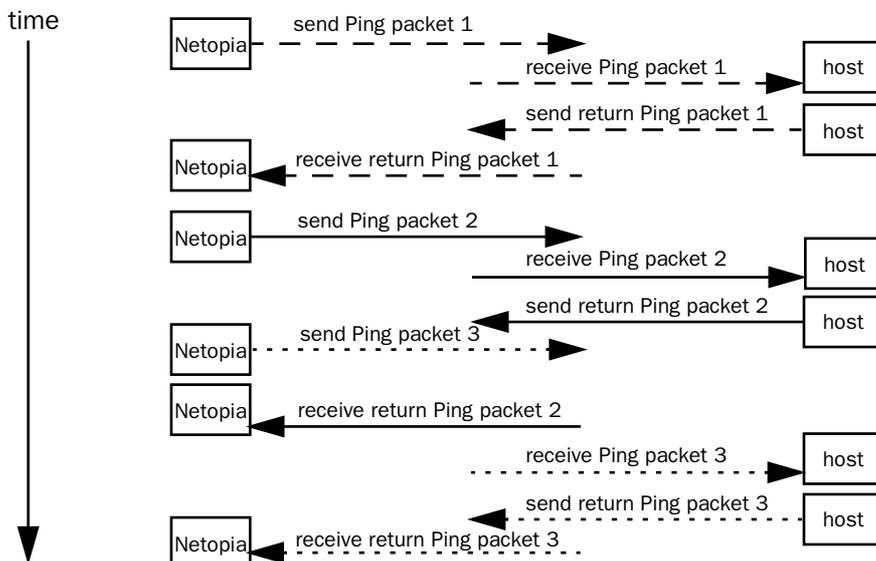
**Status:** The current status of the Ping test. This item can display the status messages shown in the table below:

Message	Description
Resolving host name	Finding the IP address for the domain name-style address
Can't resolve host name	IP address can't be found for the domain name-style address
Pinging	Ping test is in progress
Complete	Ping test was completed
Cancelled by user	Ping test was cancelled manually
Destination unreachable from w.x.y.z	Ping test was able to reach the router with IP address w.x.y.z, which reported that the test could not reach the final destination
Couldn't allocate packet buffer	Couldn't proceed with Ping test; try again or reset system
Couldn't open ICMP port	Couldn't proceed with Ping test; try again or reset system

**Packets Out:** The number of packets sent by the Ping test.

**Packets In:** The number of return packets received from the target host. To be considered on time, return packets are expected back before the next packet in the sequence of Ping packets is sent. A count of the number of late packets appears in parentheses to the right of the **Packets In** count.

In the example that follows, a Router is sending Ping packets to another host, which responds with return Ping packets. Note that the second return Ping packet is considered to be late because it is not received by the Router before the third Ping packet is sent. The first and third return Ping packets are on time.



**Packets Lost:** The number of packets unaccounted for, shown in total and as a percentage of total packets sent. This statistic may be updated during the Ping test, and may not be accurate until after the test is over. However, if an escalating one-to-one correspondence is seen between **Packets Out** and **Packets Lost**, and **Packets In** is noticeably lagging behind **Packets Out**, the destination is probably unreachable. In this case, use **STOP PING**.

**Round Trip Time (Min/Max/Avg):** Statistics showing the minimum, maximum, and average number of seconds elapsing between the time each Ping packet was sent and the time its corresponding return Ping packet was received.

The time-to-live (TTL) value for each Ping packet sent by the Router is 255, the maximum allowed. The TTL value defines the number of IP routers that the packet can traverse. Ping packets that reach their TTL value are dropped, and a “destination unreachable” notification is returned to the sender (see the table on the previous page). This ensures that no infinite routing loops occur. The TTL value can be set and retrieved using the SNMP MIB-II ip group’s ipDefaultTTL object.

---

## Trace Route

You can count the number of routers between your Netopia Router and a given destination with the Trace Route utility.

In the Statistics & Diagnostics screen, select **Trace Route** and press Return. The Trace Route screen appears.

Trace Route

Host Name or IP Address:

Maximum Hops:	30
Timeout (seconds):	5
Use Reverse DNS:	Yes

START TRACE ROUTE

Enter the IP Address/Domain Name of a host.  
Trace route to a network host.

To trace a route, follow these steps:

1. Select **Host Name or IP Address** and enter the name or address of the destination you want to trace.
2. Select **Maximum Hops** to set the maximum number of routers to count between the Netopia Router and the destination router, up to the maximum of 64. The default is 30 hops.

3. Select **Timeout (seconds)** to set when the trace will timeout for each hop, up to 10 seconds. The default is 3 seconds.
4. Select **Use Reverse DNS** to learn the names of the routers between the Netopia Router and the destination router. The default is Yes.
5. Select **START TRACE ROUTE** and press Return. A scrolling screen will appear that lists the destination, number of hops, IP addresses of each hop, and DNS names, if selected.
6. Cancel the trace by pressing Escape. Return to the Trace Route screen by pressing Escape twice.

---

## Telnet Client

The Telnet client mode replaces the normal menu mode. Telnet sessions can be cascaded, that is, you can initiate a Telnet client session when using a Telnet console session. To activate the Telnet client, select **Telnet** from the Utilities & Diagnostics menu.

The Telnet client screen appears.

```

                                Telnet
Host Name or IP Address:
Control Character to Suspend:      Q
                                START A TELNET SESSION
Resume Suspended Session...
Terminate Suspended Session...
```

- Enter the host name or the IP address in dotted decimal format of the machine you want to Telnet into and press Return.
- Either accept the default control character “Q” used to suspend the Telnet session, or type a different one.
- **START A TELNET SESSION** becomes highlighted.
- Press Return and the Telnet session will be initiated.
- To suspend the session, press Control-Q or whatever other control character you specified.
- To go back to your Telnet session, select **Resume Suspended Session**. Select a session from the pop-up

menu and press Return.

- To end a suspended session, select **Terminate Suspended Session**. Select a session from the pop-up menu and press Return.

---

## Factory Defaults

You can reset the Router to its factory default settings. In the Utilities & Diagnostics screen, select **Revert to Factory Defaults** and press Return. Select **CONTINUE** in the dialog box and press Return. The Router will reboot and its settings will return to the factory defaults, deleting your configurations.

In an emergency, you can also use the Reset switch to return the router to its factory default settings. Call Netopia Technical Support for instructions on using the Reset switch.

---

**Note:** Reset to factory defaults with caution. You will need to reconfigure all of your settings in the router.

---

If you lose your password and are unable to access the console screens, you can manually reset the router in an emergency. See [Appendix A, “Troubleshooting.”](#)

---

## Transferring Configuration and Firmware Files with TFTP

Trivial File Transfer Protocol (TFTP) is a method of transferring data over an IP network. TFTP is a client-server application, with the router as the client. To use the Router as a TFTP client, a TFTP server must be available. Netopia, Inc., has a public access TFTP server on the Internet where you can obtain the latest firmware versions.

To use TFTP, select **Trivial File Transfer Protocol (TFTP)** in the Statistics & Diagnostics screen and press Return. The Trivial File Transfer Protocol (TFTP) screen appears.

## Trivial File Transfer Protocol (TFTP)

```
TFTP Server Name:
Firmware File Name:
GET ROUTER FIRMWARE FROM SERVER...

Config File Name:
GET CONFIG FROM SERVER...
SEND CONFIG TO SERVER...

TFTP Transfer State -- Idle
TFTP Current Transfer Bytes -- 0
```

The sections below describe how to update the Router's firmware and how to download and upload configuration files.

## Updating firmware

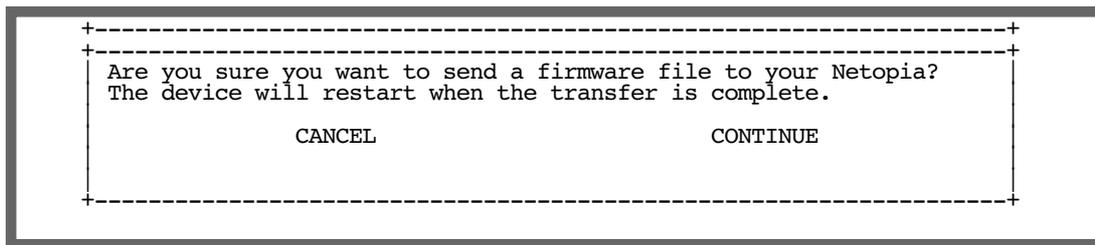
Firmware updates may be available periodically from Netopia or from a site maintained by your organization's network administrator.

The Router ships with an embedded operating system referred to as firmware. The firmware governs how the device communicates with your network and the WAN or remote site. Firmware updates are periodically posted on the Netopia website.

To update the router's firmware, follow these steps:

- Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
- Select **Firmware File Name** and enter the name of the file you will download. The name of the file is available from the site where the server is located. You may need to enter a file path along with the file name (for example, bigroot/config/myfile).

- Select **GET ROUTER FIRMWARE FROM SERVER** and press Return. You will see the following dialog box:



- Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file. The system will reset at the end of the file transfer to put the new firmware into effect. While the system resets, the LEDs will blink on and off.

### Caution!

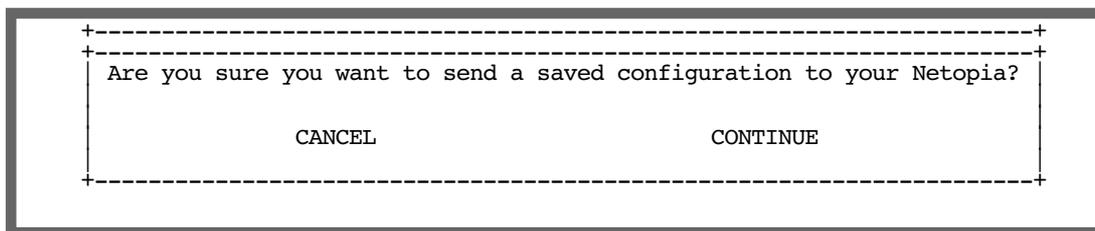
- Be sure the firmware update you load onto your router is the correct version for your particular model. Some models do not support all firmware versions. Loading an incorrect firmware version can permanently damage the unit.
- Do not manually power down or reset the Router while it is automatically resetting or it could be damaged.
- If you choose to download the firmware, the **TFTP Transfer State** item will change from **Idle** to **Reading Firmware**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

## Downloading configuration files

The Router can be configured by downloading a configuration file using TFTP. Once downloaded, the file reconfigures all of the router's parameters as if someone had manually done so through the console port.

To download a configuration file, follow these steps:

- Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
- Select **Config File Name** and enter the name of the file you will download. The name of the file is available from the site where the server is located. You may need to enter a file path along with the file name (for example, bigroot/config/myfile).
- Select **GET CONFIG FROM SERVER** and press Return. You will see the following dialog box:



- Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file. The system will reset at the end of the file transfer to put the new configuration into effect.

- If you choose to download the configuration file, the **TFTP Transfer State** item will change from **Idle** to **Reading Config**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

## Uploading configuration files

Using TFTP, you can send a file containing a snapshot of the router's current configuration to a TFTP server. The file can then be downloaded by a different Router unit to configure its parameters (see “[Downloading configuration files](#)” on page 11-8). This is useful for configuring a number of routers with identical parameters or just for creating configuration backup files.

Uploading a file can also be useful for troubleshooting purposes. The uploaded configuration file can be tested on a different Router unit by Netopia or your network administrator.

To upload a configuration file, follow these steps:

1. Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
2. Select **Config File Name** and enter a name for the file you will upload. The file will appear with the name you choose on the TFTP server. You may need to enter a file path along with the file name (for example, Mypc/Netopia/myfile).
3. Select **SEND CONFIG TO SERVER** and press Return. Netopia will begin to transfer the file.
4. The **TFTP Transfer State** item will change from **Idle** to **Writing Config**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

---

## Transferring Configuration and Firmware Files with XMODEM

You can transfer configuration and firmware files with XMODEM through the Router's console port, if available on your model. Be sure your terminal emulation program supports XMODEM file transfers.

To go to the **X-Modem File Transfer** screen, select it in the Utilities & Diagnostics menu.

**Note:** The X-Modem File Transfer screen is only available if you are connected via the Console port.

---

**Note:** It is good practice when updating programmable devices to disable any other programs or network activity on the device or the attached computer. This includes WAN traffic such as a DSL connection or screen savers or other automatic programs running on the attached computer. Such activity can slow down or interrupt the file transfer requiring you to rerun the upgrade.

---

```

                                X-Modem File Transfer

Send Firmware to Netopia...

Get Configuration Destination...   Current Configuration
Send Config to Netopia...

Send Configuration...             Current Configuration
Receive Config from Netopia...
```

## Updating firmware

Firmware updates may be available periodically from Netopia or from a site maintained by your organization's network administration.

Follow these steps to update the Router's firmware:

1. Make sure you have the firmware file on disk and know the path to its location.
2. Select **Send Firmware to Netopia** and press Return. The following dialog box appears:

```

+-----+
| Are you sure you want to send a firmware file to your Netopia? |
| If so, when you hit Return/Enter on the CONTINUE button, you will |
| have 10 seconds to begin the transfer from your terminal program. |
|                               CANCEL                               |
|                               CONTINUE                            |
+-----+
```

3. Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file.

If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the firmware file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

The system will reset at the end of a successful file transfer to put the new firmware into effect. While the system resets, the LEDs will blink on and off.

**Caution!**

Do not manually power down or reset the Router while it is automatically resetting or it could be damaged.

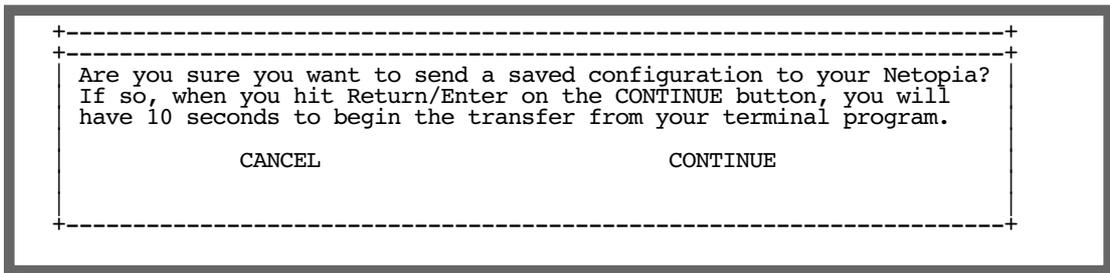
## Downloading configuration files

The Router can be configured by downloading a configuration file. The downloaded file reconfigures all of the Router's parameters.

Configuration files are available from a site maintained by your organization's network administrator or from your local site (see ["Uploading configuration files,"](#) below).

Follow these steps to download a configuration file:

1. Make sure you have the configuration file on disk and know the path to its location.
2. Select **Send Config to Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file.

If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the configuration file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

The system will reset at the end of a successful file transfer to put the new configuration into effect.

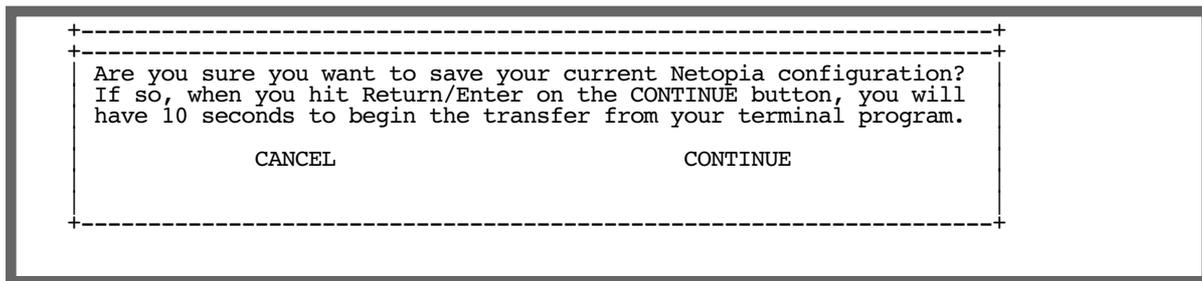
## Uploading configuration files

A file containing a snapshot of the Router's current configuration can be uploaded from the router to disk. The file can then be downloaded by a different Router to configure its parameters (see ["Downloading configuration files,"](#) above). This is useful for configuring a number of routers with identical parameters or for creating configuration backup files.

Uploading a file can also be useful for troubleshooting purposes. The uploaded configuration file can be tested on a different Router by Netopia or your network administrator.

The procedure below applies whether you are using the console or the WAN interface. To upload a configuration file:

1. Decide on a name for the file and a path for saving it.
2. Select **Receive Config from Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without uploading the file, or select **CONTINUE** to upload the file.

If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the configuration file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

---

## Restarting the System

You can restart the system by selecting the **Restart System** item in the Utilities & Diagnostics screen.

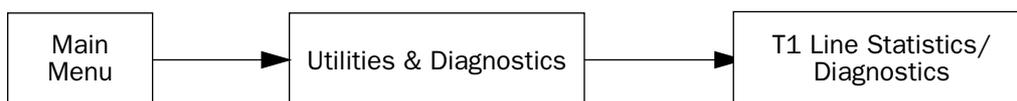
You must restart the system whenever you reconfigure the Router and want the new parameter values to take effect. Under certain circumstances, restarting the system may also clear up system or network malfunctions. Some configuration processes automatically restart the system to apply the changes you have made.

---

## T1 Line Statistics and Diagnostics

For T1 models the Utilities and Diagnostics menu includes an option for displaying T1 line statistics.

You access the Utilities and Diagnostics menu from the Main Menu.



```

                          Utilities & Diagnostics

Ping...
Trace Route...
Telnet...

Trivial File Transfer Protocol (TFTP)...
X-Modem File Transfer...

Restart System...           Revert to Factory Defaults...

T1 Line Statistics / Diagnostics...

```

Select **T1 Line Statistics / Diagnostics** and press Return.

The T1 Line Statistics / Diagnostics screen appears.

```

                          T1 Line Statistics / Diagnostics

--Condition-----00:16---00:27---00:12---1:57---1:42---24 hours-
Errored Seconds          007    000    000    000    000    00000
Unavailable Seconds      006    000    000    000    000    00000
Severely Errored Seconds 016    000    000    000    000    00000
Bursty Errored Seconds   000    000    000    000    000    00000
Loss of Frame Count      000    000    000    000    000    00000
Bipolar Violation Count  000    000    000    000    000    00000

Line Status:
Loopback Status:
Tests...

```

Normal - Clear Loopback	resent
Send Blue Alarm -all 1s	
Remote Payload Loopback	
Local Payload Loopback	
Loopback Pattern Test	

The screen displays the current condition of tests that you run. The counters display the occurrences of the indicated events in fifteen-minute increments, shifting the totals to the column to the right after each fifteen minute cycle until the total is accumulated in the **24 hours** column.

**Condition:** Displays the parameters tested.

**Time columns:** Current time (00:00) starts at zero and resets to zero at 15:00 minutes, shifting the counted total to the next column to its right.

**24 hours:** Cumulative statistics, for the preceding 24-hour period.

**Line Status:** Conditions may be Normal Operation, Red Alarm, Yellow Alarm, or (Rmt/Lcl) LoopBack

**Loopback Status:** Current loopback condition

**Tests:** Offers a pop-up menu with the following options:

- **Normal - Clear Loopback** clears any local loopbacks and sends an ANSI PLB clear to the remote CSU. This returns the Netopia Router to its normal state if any testing has been done and the router has been put into a looped state. Select this option after running tests to return the router to a normal state so that it is capable of passing traffic as it should.
- **Send Blue Alarm -all 1s** forces an error condition of all 1s; remote will send a yellow alarm if enabled. You can use this pattern in two different ways. Once a remote router has been looped you can use it to verify that you are receiving the same data that you are sending. For example, if you send all ones across the line and get back a mixture of ones and zeroes, there is a problem. You can also use this test in a different way. If you send all ones to a remote device, it should report that it is receiving all ones. This would verify (without having to put up a loop) that data is reaching the destination intact. It does not verify bi-directional integrity however, which is verified if you have the remote end in loop. This pattern is also for checking the remote end's capability of reporting back a yellow alarm (usually something that is optionally enabled on the remote CSU).
- **Remote Payload Loopback** sends an ANSI BPM payload loopback request to the remote CSU. This pattern tells the remote device (usually the CSU at the other end of the circuit) that it should go into a looped state. Use this pattern for putting up a loop to do testing from a remote portion of the circuit, either by the Telco or by the CPE at the remote end of the circuit. This test makes the remote CSU go into a looped state so that any data you send it is returned to you. This is useful for determining if the remote CSU is receiving data from the CPE. If it does not loop then you can conclude that it is not receiving any data from you.
- **Local Payload Loopback** enables a local payload loopback. This pattern is similar to the Remote Payload Loopback pattern except that it puts the local CSU into a looped state rather than the remote CSU. This is useful if the remote side is not able to send a remote loop code to the router to put it into a looped state. You can simply put it into loopback manually and see if that loop is reflected at the remote side.
- **Loopback Pattern Test** sends continuous 1200 byte packets and compares incoming packets (similar to ISDN loopback tests), counting good and bad packets. Twenty consecutive good packets are required to PASS. The loopback testing screen is only visible when this test is selected. It sends a pseudo-random sequence that is intended to simulate data so that you can check for errors on the circuit. This test requires that the remote CSU be in a payload loopback condition. (It will partially work if the remote CSU is in a LINE loopback condition as well, but this is less reliable.)

When you select one of these tests and press Return, the test runs and the screen provides feedback.

# Appendix A

## Troubleshooting

This appendix is intended to help you troubleshoot problems you may encounter while setting up and using the Netopia Firmware Version 5.4. It also includes information on how to contact Netopia Technical Support.

Important information on these problems can be found in the event histories kept by the Router. These event histories can be accessed in the Statistics & Logs screen.

This section covers the following topics:

- [“Configuration Problems” on page A-1](#)
- [“How to Reset the Router to Factory Defaults” on page A-3](#)
- [“Power Outages” on page A-3](#)
- [“Technical Support” on page A-4](#)

---

## Configuration Problems

If you encounter problems during your initial configuration process, review the following suggestions before calling for technical support. There are four zones to consider when troubleshooting initial configuration:

1. The computer’s connection to the router
2. The router’s connection to the telecommunication line(s)
3. The telecommunication line’s connection to your ISP
4. The ISP’s connection to the Internet

If the connection from the computer to the router was not successful, verify that the following conditions are in effect:

- The Router is turned on.
- An Ethernet cable connects your PC’s Ethernet card or built-in Ethernet port to the Router.
- Telnet is available on your PC or Macintosh. (On a PC, it must be specified in your system path. You can usually find the application as “c:\windows\telnet.exe”.)
- Your PC or Macintosh is properly configured for TCP/IP.
- Your PC or Macintosh has an IP address.
- Your PC or Macintosh has a subnet mask that matches or is compatible with the Router’s subnet mask.

---

**Note:** If you are attempting to modify the IP address or subnet mask from a previous, successful configuration attempt, you will need to clear the IP address or reset your Router to the factory default before reinitiating the configuration process. For further information on resetting your Router to factory default, see [“How to Reset the Router to Factory Defaults”](#) on page A-3.

---

## Console connection problems

### *Can't see the configuration screens (nothing appears)*

- Make sure the cable connection from the Router's console port to the computer being used as a console is securely connected.
- Make sure the terminal emulation software is accessing the correct port on the computer that's being used as a console.
- Try pressing Ctrl-L or Return or the up or down arrow key several times to refresh the terminal screen.
- Make sure that flow control on serial connections is turned off.

### *Junk characters appear on the screen*

- Check that the terminal emulation software is configured correctly.
- Check the baud rate. The default values are 9600, N, 8, and 1.

### *Characters are missing from some of the configuration screens*

- Try changing the Router's default speed of 9600 bps and setting your terminal emulation software to match the new speed.

## Network problems

### *Problems communicating with remote IP hosts*

- Verify the accuracy of the default gateway's IP address (entered in the IP Setup or Easy Setup screen).
- Use the Netopia Firmware Version 5.4's Ping utility, in the Utilities & Diagnostics screen, and try to Ping local and remote hosts. See [“Ping”](#) on page 11-2 for instructions on how to use the Ping utility. If you can successfully Ping hosts using their IP addresses but not their domain names (198.34.7.1 but not [garcia.netopia.com](#), for example), verify that the DNS server's IP address is correct and that it is reachable from the Router (use Ping).
- If you are using filters, check that your filter sets are not blocking the type of connections you are trying to make.

### *Local routing problems*

- Observe the Ethernet LEDs to see if data traffic flow appears to be normal.
- Check the WAN statistics and LAN statistics screens to see more specific information on data traffic flow and address serving. See [“Statistics & Logs”](#) on page 9-4 for more information.

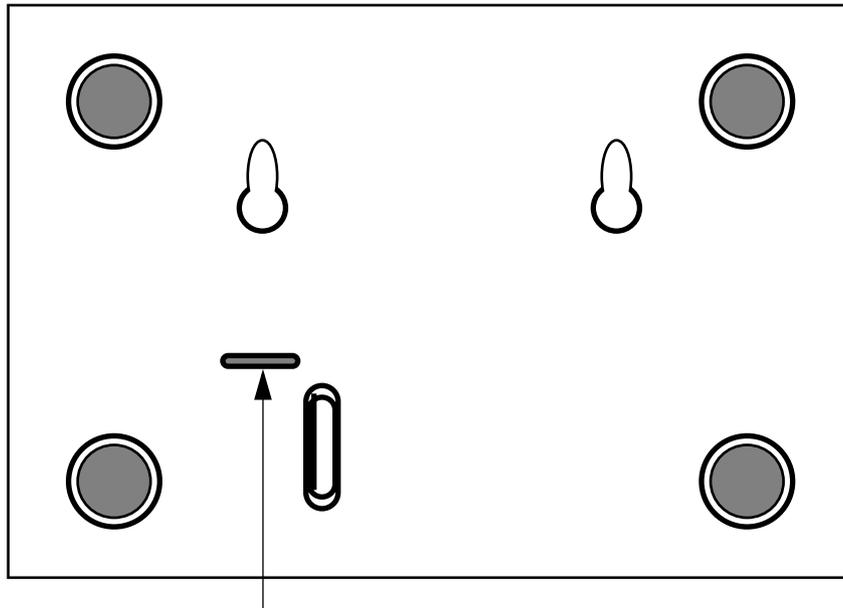
---

## How to Reset the Router to Factory Defaults

Lose your password? This section shows how to reset the router so that you can access the console screens once again. Keep in mind that all of your connection profiles and settings will need to be reconfigured.

If you don't have a password, the only way to get back into the Router is the following:

1. Turn the router upside down.
2. Referring to the diagram below, find the paper clip-size Reset Switch slot.



**Reset Switch Slot**

3. Carefully insert the larger end of a standard size paper clip until you contact the internal Reset Switch. (No need to unwind the paper clip.)
4. Press this switch.
5. This will reset the unit to factory defaults and you will now be able to reprogram the router.

---

## Power Outages

If you suspect that power was restored after a power outage and the Router is connected to a remote site, you may need to switch the Router off and then back on again. After temporary power outages, a connection that still seems to be up may actually be disconnected. Rebooting the router should reestablish the connection.

## **Technical Support**

Netopia, Inc. is committed to providing its customers with reliable products and documentation, backed by excellent technical support.

### **Before contacting Netopia**

Look in this guide for a solution to your problem. You may find a solution in this troubleshooting appendix or in other sections. Check the index for a reference to the topic of concern. If you cannot find a solution, complete the environment profile below before contacting Netopia Technical Support.

### **Environment profile**

- Locate the Router's model number, product serial number, and firmware version. The serial number is on the bottom of the router, along with the model number. The firmware version appears in the Netopia Firmware Version 5.4's Main Menu screen.

Model number:

Serial number:

Firmware version:

- What kind of local network(s) do you have, with how many devices?

Ethernet

TCP/IP

## **How to reach us**

We can help you with your problem more effectively if you have completed the environment profile in the previous section. If you contact us by telephone, please be ready to supply Netopia Technical Support with the information you used to configure the Router. Also, please be at the site of the problem and prepared to reproduce it and to try some troubleshooting steps.

When you are prepared, contact Netopia Technical Support by e-mail, telephone, or post:

Internet: ask\_netopia@netopia.com (for technical support)

info@netopia.com (for general information)

Phone: 1 510-597-5400

Netopia, Inc.

Customer Services

6001 Shellmound Street

Emeryville, California 94608

USA

### **Online product information**

Product information can be found in the following:

Netopia World Wide Web server via <http://www.netopia.com>

Internet via anonymous FTP to <ftp.netopia.com/pub>

## Appendix B

# Understanding IP Addressing

This appendix is a brief general introduction to IP addressing. A basic understanding of IP will help you in configuring the Netopia Firmware Version 5.4 and using some of its powerful features, such as static routes and packet filtering.

This section covers the following topics:

- “What is IP?” on page B-1
- “About IP Addressing” on page B-1
- “Distributing IP Addresses” on page B-5
- “Nested IP Subnets” on page B-11
- “Broadcasts” on page B-14

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## What is IP?

All networks use protocols to establish common standards for communication. One widely used network protocol is the Internet Protocol, also known as IP. Like many other protocols, IP uses packets, or formatted chunks of data, to communicate. In packets, a header is part of the envelope information that surrounds the actual data being transmitted. In e-mail, a header is usually the address and routing information found at the top of messages.

---

**Note:** This guide uses the term “IP” in a very general and inclusive way to identify all of the following:

- Networks that use the Internet Protocol, along with accompanying protocols such as TCP, UDP, and ICMP
- Packets that include an IP header within their structure
- Devices that send IP packets

---

## About IP Addressing

Every networking protocol uses some form of addressing in order to ensure that packets are delivered correctly. In IP, individual network devices that are initial sources and final destinations of packets are usually called hosts instead of nodes, but the two terms are interchangeable. Each host on an IP network must have a unique IP address. An IP address, also called an Internet address, is a 32-bit number usually expressed as four decimal numbers separated by periods. Each decimal number in an IP address represents a 1-byte (8-bit) binary number. Thus, values for each of the four numbers range from 00000000 to 11111111 in binary notation, or from 0 to 255 in decimal notation. The expression 192.168.1.1 is a typical example of an IP address.

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IP addresses indicate both the identity of the network and the identity of the individual host on the network. The number of bits used for the network number and the number of bits used for the host number can vary, as long as certain rules are followed. The local network manager assigns IP host numbers to individual machines.

IP addresses are maintained and assigned by the InterNIC, a quasi-governmental organization now increasingly under the auspices of private industry.

---

**Note:** It's very common for an organization to obtain an IP address from a third party, usually an Internet service provider (ISP). ISPs usually issue an IP address when they are contracted to provide Internet access services.

---

The InterNIC (the NIC stands for Network Information Center) divides IP addresses into several classes. Classes A, B, and C are assigned to organizations that request addresses. In Class A networks, the first byte of an IP address is reserved for the network portion of the address. Class B networks reserve the first two bytes of an IP address for the network address. Class C networks reserve the first three bytes of an IP address for the network address. In all cases, a network manager can decide to use subnetting to assign even more bits to the network portion of the IP address, but never less than the class requires. The following section gives more information on subnetting.

Class A networks have a small number of possible network numbers, but a large number of possible host numbers. Conversely, Class C networks have a small number of possible host numbers, but a large number of possible network numbers. Thus, the InterNIC assigns Class A addresses to large organizations that have very large numbers of IP hosts, while smaller organizations, with fewer hosts, get Class B or Class C addresses. You can tell the various classes apart by the value of the first (or high-order) byte. Class A networks use values from 1 to 127, Class B networks use values from 128 to 191, and Class C networks use values from 192 to 223. The following table summarizes some of the differences between Class A, B, and C networks.

Class	First byte	Number of networks possible per class	Number of hosts possible per network	Format of address (without subnetting)	Example
A	1–127	127	16,777,214	net.host.host.host	97.3.14.250
B	128–191	16,384	65,534	net.net.host.host	140.100.10.11
C	192–223	2,097,152	254	net.net.net.host	197.204.13.7

## Subnets and subnet masks

Often an entire organization is assigned only one IP network number. If the organization has several IP networks connected together with IP routers, the network manager can use subnetting to distinguish between these networks, even though they all use the same network number. Each physical network becomes a subnet with a unique subnet number.

Subnet numbers appear within IP addresses, along with network numbers and host numbers. Since an IP address is always 32 bits long, using subnet numbers means either the network number or the host numbers must use fewer bits in order to leave room for the subnet numbers. Since the InterNIC assigns the network number proper, it should not change, so the subnet numbers must be created out of bits that would otherwise be part of the host numbers.

## Subnet masks

To create subnets, the network manager must define a subnet mask, a 32-bit number that indicates which bits in an IP address are used for network and subnetwork addresses and which are used for host addresses. One subnet mask should apply to all IP networks that are physically connected together and share a single assigned network number. Subnet masks are often written in decimal notation like IP addresses, but they are most easily understood in binary notation. When a subnet mask is written in binary notation, each numeral 1 indicates that the corresponding bit in the IP address is part of the network or subnet address. Each 0 indicates that the corresponding bit is part of the host address. The following table shows the proper subnet masks to use for each class of network when no subnets are required.

Class	Subnet mask for a network with no subnets
A	Binary: 11111111.00000000.00000000.00000000 Decimal: 255.0.0.0
B	Binary: 11111111.11111111.00000000.00000000 Decimal: 255.255.0.0
C	Binary: 11111111.11111111.11111111.00000000 Decimal: 255.255.255.0

To know whether subnets are being used or not, you must know what subnet mask is being used—you cannot determine this information simply from an IP address. Subnet mask information is configured as part of the process of setting up IP routers and gateways such as the Router.

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**Note:** If you receive a routed account from an ISP, there must be a mask associated with your network IP address. By using the IP address with the mask you can discover exactly how many IP host addresses you actually have.

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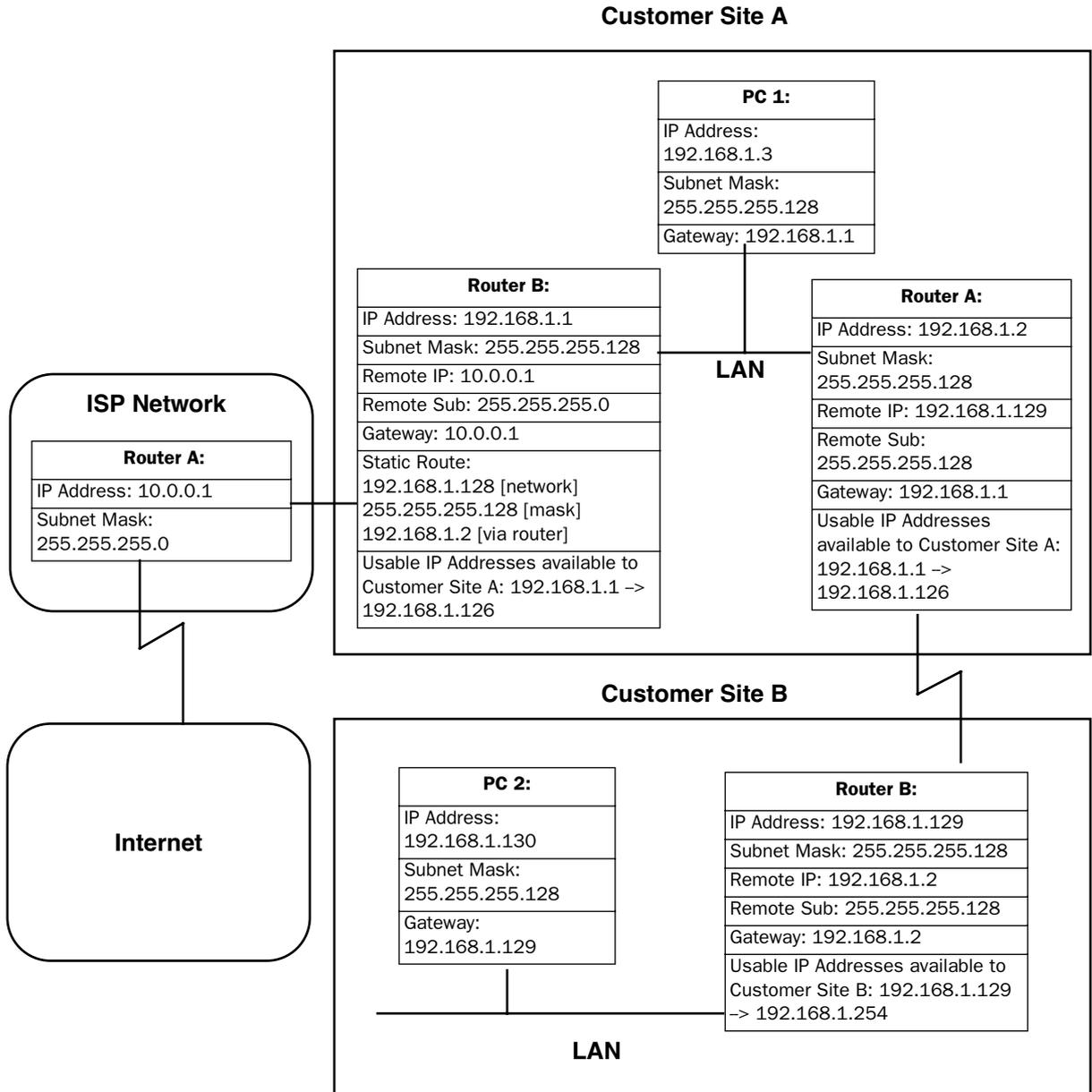
To configure subnets properly, you must also be able to convert between binary notation and decimal notation.

## Example: Using subnets on a Class C IP internet

When setting up IP routing with a Class A address, or even with multiple Class C addresses, subnetting is fairly straightforward. Subnetting a single Class C address between two networks, however, is more complex. This section describes the general procedures for subnetting a single Class C network between two Netopia routers so that each can have Internet access.

## Network configuration

Below is a diagram of a simple network configuration. The ISP is providing a Class C address to the customer site, and both networks A and B want to gain Internet access through this address. Router B connects to Router A and is provided Internet access through Routers A and B.



## Background

The IP addresses and routing configurations for the devices shown in the diagram are outlined below. In addition, each individual field and its meaning are described.

The IP Address and Subnet Mask fields define the IP address and subnet mask of the device's Ethernet connection to the network while the Remote IP and Remote Sub fields describe the IP address and subnet mask of the remote router. This information is entered in the connection profile of the Router.

The Gateway field describes the router or workstation's default gateway, or where they will send their packets if the appropriate route is not known. The Static Route field, which is only shown on Router B, tells Router B what path to take to get to the network defined by Router B. Finally, the Usable IP Address field shows the range of IP addresses available to the hosts of that network.

Note that the IP addresses given in this section are for example purposes only. Do not use these addresses when configuring your network.

With this configuration, both Customer Site A and B can gain Internet access through Routers A and B, with no reconfiguration of the ISP's equipment. The most important item in this configuration is the static route defined on Router B. This tells Router B what path to take to get to the network defined by Router B. Without this information, Customer Site B will be able to access Customer Site A, but not the Internet.

If it is not possible to define a static route on Router B, RIP could be enabled to serve the same purpose. To use RIP instead of a static route, enable Transmit RIP on Router A and Transmit and Receive RIP on Router B. This will allow the route from Customer Site B to propagate on Router B and Customer Site A.

## Example: Working with a Class C subnet

Suppose that your organization has a site with only 10 hosts and no plans to add any new hosts. You don't need a full Class C address for this site. Many ISPs offer Internet access with only a portion of a full Internet address.

For example, you might obtain the Class C address 199.14.17.48, with the mask 255.255.255.240. From the previous example, you can see that this gives you 14 host addresses to distribute to the hosts at your site. In effect, your existing network of 10 hosts is a subnet of the ISP's network. Since the Class C address has already been reduced to subnets, you cannot further subnet your network without the risk of creating network routing problems (since you must use the mask issued by the ISP). This, however, is not a problematic limitation for your small network.

The advantages of this situation are the greater ease and lower cost of obtaining a subnet rather than a full Class C address from an ISP.

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## Distributing IP Addresses

To set up a connection to the Internet, you may have obtained a block of IP host addresses from an ISP. When configuring the Router, you gave one of those addresses to its Ethernet port, leaving a number of addresses to distribute to computers on your network.

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There are two schemes for distributing the remaining IP addresses:

- Manually give each computer an address
- Let the Router automatically distribute the addresses

These two methods are not mutually exclusive; you can manually issue some of the addresses while the rest are distributed by the Router. Using the router in this way allows it to function as an address server.

One reason to use the Router as an address server is that it takes less time than manually distributing the addresses. This is particularly true if you have many addresses to distribute. You need to enter information only once, rather than having to enter it on each host separately. This also reduces the potential for misconfiguring hosts.

Another reason to use the Router as an address server is that it will distribute addresses only to hosts that need to use them.

All Routers come with an integrated Dynamic Host Control Protocol (DHCP) server. Some routers also come with a Macintosh Internet Protocol (MacIP) server. These servers provide a means of distributing IP addresses to either a Mac or PC workstation as needed.

When setting up the DHCP or MacIP servers in the Router, it is necessary to understand how workstations lease, renew, and release their IP addresses. This information is helpful in determining dynamic address allocation for a network.

The term “lease” describes the action of a workstation requesting and using an IP address. The address is dynamic and can be returned to the address pool at a later time.

The term “renew” refers to what the workstations do to keep their leased IP address. At certain intervals, the workstation talks to the DHCP or MacIP server and renews the lease on that IP address. This renewal allows the workstation to keep and use the assigned IP address until the next renewal period.

The term “release” refers to a situation where the workstation is no longer using its assigned IP address or has been shut down. IP addresses can be manually released as well. The IP address goes back into the DHCP or MacIP address pool to be reassigned to another workstation as needed.

## Technical note on subnet masking

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**Note:** The IP address supplied by the Router will be a unique number. You may want to replace this number with a number that your ISP supplies if you are configuring the router for a static IP address. However, the Router and all devices on the same local network must have the same subnet mask. If you require a different class address, you can edit the IP Mask field to enter the correct address. Refer to the table below.

---

Number of Devices (other than Router) on Local Network	Largest Possible Ethernet Subnet Mask
1	255.255.255.252
2-5	255.255.255.248 (6)
6-13	255.255.255.240 (14)
14-29	255.255.255.224 (30)

Number of Devices (other than Router) on Local Network	Largest Possible Ethernet Subnet Mask
30-61	255.255.255.192
62-125	255.255.255.128
125-259	255.255.255.0

## Configuration

This section describes the specific IP address lease, renew, and release mechanisms for both the Mac and PC, with either DHCP or MacIP address serving.

### *DHCP address serving*

#### **Windows 95 workstation:**

- The Win95 workstation requests and renews its lease every half hour.
- The Win95 workstation does NOT relinquish its DHCP address lease when the machine is shut down.
- The lease can be manually expired using the WINIPCFG program, a command line program executable from the DOS prompt or from the START:RUN menu on a Windows-based computer.

#### **Windows 3.1 workstation (MSTCP Version 3.11a):**

- The Win3.1 workstation requests and renews its lease every half hour.
- The Win3.1 workstation does NOT relinquish its DHCP address lease when the user exits Windows and goes to DOS.
- The lease can be manually expired by typing IPCONFIG/RELEASE from a DOS window within Windows or from the DOS prompt.

#### **Macintosh workstation (Open Transport Version 1.1 or later):**

- The Mac workstation requests and renews its lease every half hour.
- The Mac workstation relinquishes its address upon shutdown in all but one case. If the TCP/IP control panel is set to initialize at startup, and no IP services are used or the TCP/IP control panel is not opened, the DHCP address will NOT be relinquished upon shutdown. However, if the TCP/IP control panel is opened or if an IP application is used, the Mac WILL relinquish the lease upon shutdown.
- If the TCP/IP control panel is set to acquire an address only when needed (therefore a TCP/IP application must have been launched to obtain a lease) the Mac WILL relinquish its lease upon shutdown every time.

### *Netopia Firmware Version 5.4 DHCP server characteristics*

- The Netopia Firmware Version 5.4 ignores any lease-time associated with a DHCP request and automatically issues the DHCP address lease for one hour.
- The number of devices a Router can serve DHCP to is 512. This is imposed by global limits on the size of the address serving database, which is shared by all address serving functions active in the router.

- The Router releases the DHCP address back to the available DHCP address pool exactly one hour after the last-heard lease request. Some other DHCP implementations may hold on to the lease for an additional time after the lease expired to act as a buffer for variances in clocks between the client and server.

### **MacIP serving**

**Macintosh workstation** (MacTCP or Open Transport):

Once the Mac workstation requests and receives a valid address, the Router actively checks for the workstation's existence once every minute.

- For a dynamic address, the Router releases the address back to the address pool after it has lost contact with the Mac workstation for over 2 minutes.
- For a static address, the Router releases the address back to the address pool after it has lost contact with the Mac workstation for over 20 minutes.

### **Netopia Firmware Version 5.4 MacIP server characteristics**

The Mac workstation uses ATP to both request and receive an address from the Router's MacIP server. Once acquired, NBP confirm packets will be sent out every minute from the Router to the Mac workstation.

## **Manually distributing IP addresses**

If you choose to manually distribute IP addresses, you must enter each computer's address into its TCP/IP stack software. Once you manually issue an address to a computer, it possesses that address until you manually remove it. That's why manually distributed addresses are called static addresses.

Static addresses are useful in cases when you want to make sure that a host on your network cannot have its address taken away by the address server. Appropriate candidates for a static address include a network administrator's computer, a computer dedicated to communicating with the Internet, and routers.

## **Using address serving**

The Router provides three ways to serve IP addresses to computers on a network. The first, Dynamic Host Configuration Protocol (DHCP), is supported by PCs with Microsoft Windows and a TCP/IP stack. Macintosh computers using Open Transport and computers using the UNIX operating system may also be able to use DHCP. The second way, MacIP, is for Macintosh computers. The third way, called Serve Dynamic WAN Clients (IPCP), is used to fulfill WAN client requirements.

The Router can use both DHCP and MacIP. Whether you use one or both depends on your particular networking environment. If that environment includes both PCs and Macintosh computers that do not use Open Transport, you need to use both DHCP and MacIP to distribute IP addresses to all of your computers.

### **Serve dynamic WAN clients**

The third method, used to fulfill WAN client requirements, is called Serve Dynamic WAN Clients. The correct term or protocol is a subset of the PPP suite called IPCP. Originally, this would apply only to switched WAN interface routers, and not to leased line routers. However, a new feature can give you Asynchronous PPP dial-in support on the Auxiliary port on any router including leased line Netopia routers.

In any situation where a device is dialing into a Netopia router, the router may need to be configured to serve IP via the WAN interface. This is only a requirement if the calling device has not been configured locally to know what its address(es) are. So when a client, dialing into a Netopia router's WAN interface, is expecting addresses to be served by the answering router, you must set the answering Netopia router to serve IP via its WAN interface.

You can do this in either of two ways:

- use the Serve Dynamic WAN Clients option in the Address Serving Setup screen.

Enabling Serve Dynamic WAN Clients only allows you to specify a pool of addresses from which the dial-in client may get an IP address. It does not allow static addressing.

If you want to serve addresses dynamically, use Serve Dynamic WAN Clients.

- define the address that you want to serve in the Connection Profile's IP Setup screen.

This method requires a static value to be used. Thus any user dialing in can obtain the same IP address for every connection to the profile.

If you want to serve addresses statically, define the address in the Connection Profile.

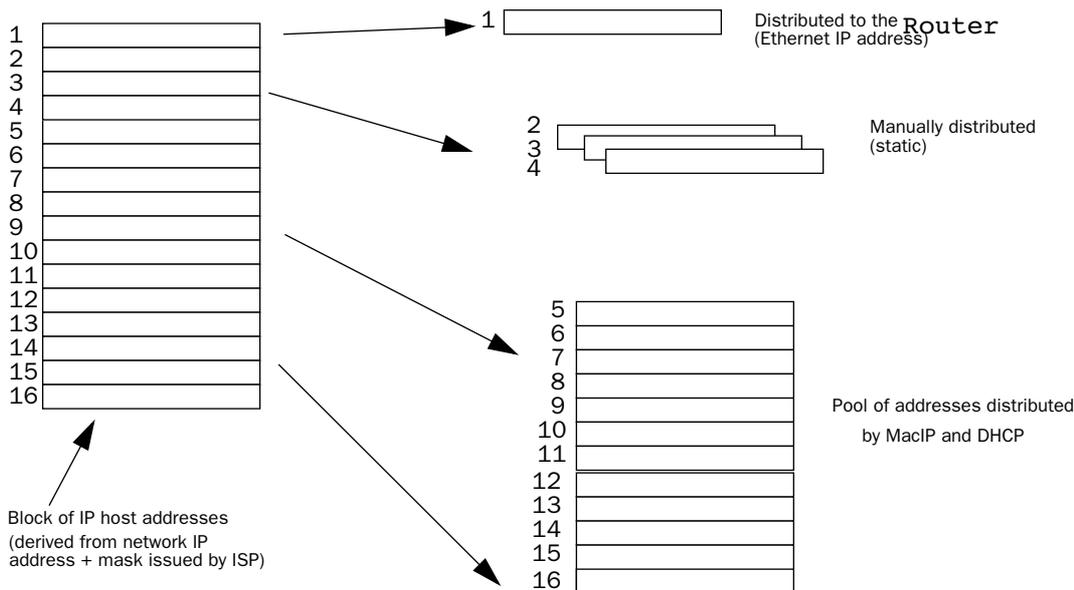
**Notes:**

- The addresses that are to be served cannot be used elsewhere. For example you wouldn't want to define a static address in a Connection Profile to be served via the WAN that is already defined in the DHCP pool of addresses.
- In order to work correctly, you must define a host or node address in the IP Profile Parameters of the Connection Profile.

This is accomplished by specifying the IP address that is to be statically served via the WAN, and then by entering a mask value of 255.255.255.255.

## **Tips and rules for distributing IP addresses**

- Before you allocate IP addresses using DHCP and MacIP, consider whether you need to set aside any static addresses.
- Note any planned and currently used static addresses before you use DHCP and MacIP.
- Avoid fragmenting your block of IP addresses. For example, try to use a continuous range for the static addresses you choose.



The figure above shows an example of a block of IP addresses being distributed correctly.

The example follows these rules:

- An IP address must not be used as a static address if it is also in a range of addresses being distributed by DHCP or MacIP.
- A single IP address range is used by all the address-served clients. These include DHCP, BootP, MacIP, and WAN clients, even though BootP and static MacIP clients might not be considered served.
- The address range specified for address-served clients cannot wrap around from the end of the total available range back to the beginning. See below for a further explanation and an example.
- The network address issued by an ISP cannot be used as a host address.

### **A DHCP example**

Suppose, for example, that your ISP gave your network the IP address 199.1.1.32 and a 4-bit subnet mask. Address 199.1.1.32 is reserved as the network address. Address 199.1.1.47 is reserved as the broadcast address. This leaves 14 addresses to allocate, from 199.1.1.33 through 199.1.1.46. If you want to allocate a sub-block of 10 addresses using DHCP, enter "10" in the DHCP Setup screen's **Number of Addresses to Allocate** item. Then, in the same screen's **First Address** item, enter the first address in the sub-block to allocate so that all 10 addresses are within your original block. You could enter 199.1.1.33, or 199.1.1.37, or any address between them. Note that if you entered 199.1.1.42 as the first address, network routing errors would probably result because you would be using a range with addresses that do not belong to your network (199.1.1.49, 199.1.1.50, and 199.1.1.51). The DHCP server would not initialize if set incorrectly.

---

## *Nested IP Subnets*

Under certain circumstances, you may want to create remote subnets from the limited number of IP addresses issued by your ISP or other authority. You can do this using connection profiles. These subnets can be nested within the range of IP addresses available to your network.

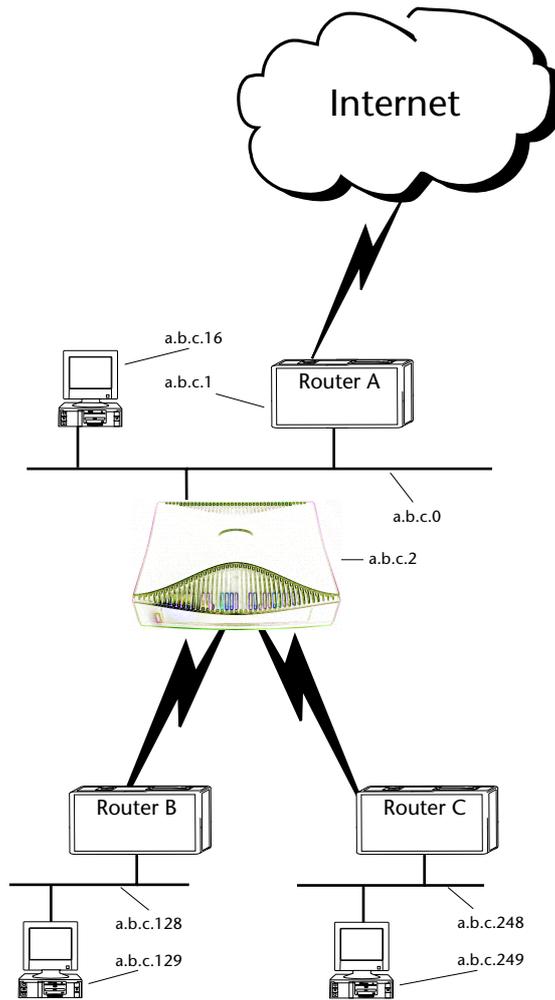
For example, suppose that you obtain the Class C network address a.b.c.0 to be distributed among three networks. This network address can be used on your main network, while portions of it can be subnetted to the two remaining networks.

---

**Note:** The IP address a.b.c.0 has letters in place of the first three numbers to generalize it for this example.

---

The figure shows a possible network configuration following this scheme. The main network is set up with the Class C address a.b.c.0, and contains Router A (which could be a Router), a Router, and a number of other hosts. Router A maintains a link to the Internet and can be used as the default gateway.



Routers B and C (which could also be Routers) serve the two remote networks that are subnets of a.b.c.0. The subnetting is accomplished by configuring the Router with connection profiles for Routers B and C (see the following table).

Connection profile	Remote IP address	Remote IP mask	Bits available for host address
For Router B	a.b.c.128	255.255.255.192	7
For Router C	a.b.c.248	255.255.255.248	3

The Router's connection profiles for Routers B and C create entries in its IP routing table. One entry points to the subnet a.b.c.128, while a second entry points to the subnet a.b.c.248. The IP routing table might look similar to the following:

IP Routing Table					
Network Address	Subnet Mask	via Router	Port	Type	
-----SCROLL UP-----					
0.0.0.0	0.0.0.0	a.b.c.1	--	Other	
127.0.0.1	255.255.255.255	127.0.0.1	Loopback	Local	
a.b.c.128	255.255.255.192	a.b.c.128	WAN	Local	
a.b.c.248	255.255.255.248	a.b.c.248	WAN	Local	
-----SCROLL DOWN-----					
UPDATE					

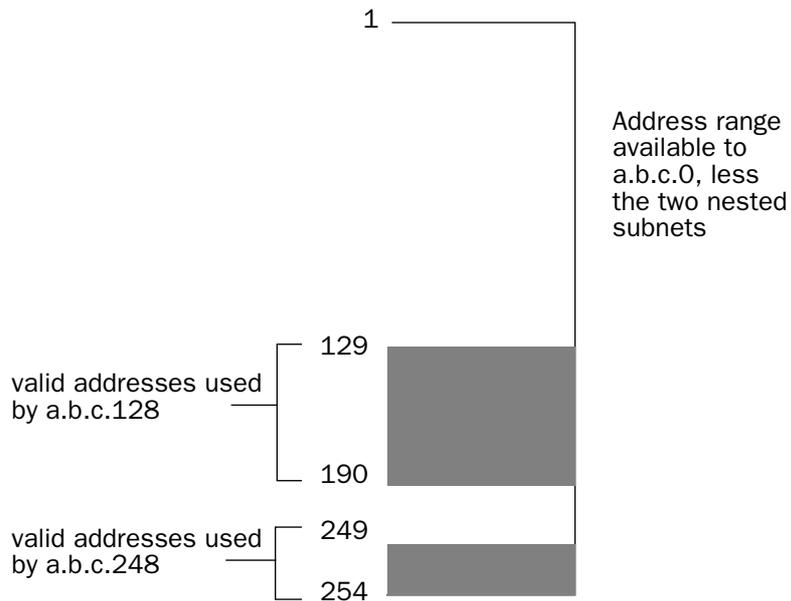
Let's see how a packet from the Internet gets routed to the host with IP address a.b.c.249, which is served by Router C. The packet first arrives at Router A, which delivers it to its local network (a.b.c.0). The packet is then received by the Router, which examines its destination IP address.

The Router compares the packet's destination IP address with the routes in its IP routing table. It begins with the route at the bottom of the list and works up until there's a match or the route to the default gateway is reached.

When a.b.c.249 is masked by the first route's subnet mask, it yields a.b.c.248, which matches the network address in the route. The Router uses the connection profile associated with the route to connect to Router C, and then forwards the packet. Router C delivers the packet to the host on its local network.

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The following diagram illustrates the IP address space taken up by the two remote IP subnets. You can see from the diagram why the term nested is appropriate for describing these subnets.



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## Broadcasts

As mentioned earlier, binary IP host or subnet addresses composed entirely of ones or zeros are reserved for broadcasting. A broadcast packet is a packet that is to be delivered to every host on the network if both the host address and the subnet address are all ones or all zeros, or to every host on the subnetwork if the host address is all ones or all zeros but the subnet address is a combination of zeros and ones. Instead of making many copies of the packet, individually addressed to different hosts, all the host machines know to pay attention to broadcast packets, as well as to packets addressed to their specific individual host addresses. Depending on the age and type of IP equipment you use, broadcasts will be addressed using either all zeros or all ones, but not both. If your network requires zeros broadcasting, you must configure this through SNMP.

## Packet header types

As previously mentioned, IP works with other protocols to allow communication over IP networks. When IP is used on an Ethernet network, IP works with the Ethernet or 802.3 framing standards, among other protocols. These two protocols specify two different ways to organize the very first signals in the sequence of electrical signals that make up an IP packet travelling over Ethernet. By default, the Router uses Ethernet packet headers for IP traffic. If your network requires 802.3 IP framing, you must configure this through SNMP.

# Appendix C

## Binary Conversion Table

This table is provided to help you choose subnet numbers and host numbers for IP and MacIP networks that use subnetting for IP addresses.

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
0	0	32	100000	64	1000000	96	1100000
1	1	33	1000001	65	1000001	97	1100001
2	10	34	100010	66	1000010	98	1100010
3	11	35	100011	67	1000011	99	1100011
4	100	36	100100	68	1000100	100	1100100
5	101	37	100101	69	1000101	101	1100101
6	110	38	100110	70	1000110	102	1100110
7	111	39	100111	71	1000111	103	1100111
8	1000	40	101000	72	1001000	104	1101000
9	1001	41	101001	73	1001001	105	1101001
10	1010	42	101010	74	1001010	106	1101010
11	1011	43	101011	75	1001011	107	1101011
12	1100	44	101100	76	1001100	108	1101100
13	1101	45	101101	77	1001101	109	1101101
14	1110	46	101110	78	1001110	110	1101110
15	1111	47	101111	79	1001111	111	1101111
16	10000	48	110000	80	1010000	112	1110000
17	10001	49	110001	81	1010001	113	1110001
18	10010	50	110010	82	1010010	114	1110010
19	10011	51	110011	83	1010011	115	1110011
20	10100	52	110100	84	1010100	116	1110100
21	10101	53	110101	85	1010101	117	1110101
22	10110	54	110110	86	1010110	118	1110110
23	10111	55	110111	87	1010111	119	1110111
24	11000	56	111000	88	1011000	120	1111000
25	11001	57	111001	89	1011001	121	1111001
26	11010	58	111010	90	1011010	122	1111010
27	11011	59	111011	91	1011011	123	1111011
28	11100	60	111100	92	1011100	124	1111100
29	11101	61	111101	93	1011101	125	1111101
30	11110	62	111110	94	1011110	126	1111110
31	11111	63	111111	95	1011111	127	1111111

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<b>Decimal</b>	<b>Binary</b>	<b>Decimal</b>	<b>Binary</b>	<b>Decimal</b>	<b>Binary</b>	<b>Decimal</b>	<b>Binary</b>
128	10000000	160	10100000	192	11000000	224	11100000
129	10000001	161	10100001	193	11000001	225	11100001
130	10000010	162	10100010	194	11000010	226	11100010
131	10000011	163	10100011	195	11000011	227	11100011
132	10000100	164	10100100	196	11000100	228	11100100
133	10000101	165	10100101	197	11000101	229	11100101
134	10000110	166	10100110	198	11000110	230	11100110
135	10000111	167	10100111	199	11000111	231	11100111
136	10001000	168	10101000	200	11001000	232	11101000
137	10001001	169	10101001	201	11001001	233	11101001
138	10001010	170	10101010	202	11001010	234	11101010
139	10001011	171	10101011	203	11001011	235	11101011
140	10001100	172	10101100	204	11001100	236	11101100
141	10001101	173	10101101	205	11001101	237	11101101
142	10001110	174	10101110	206	11001110	238	11101110
143	10001111	175	10101111	207	11001111	239	11101111
144	10010000	176	10110000	208	11010000	240	11110000
145	10010001	177	10110001	209	11010001	241	11110001
146	10010010	178	10110010	210	11010010	242	11110010
147	10010011	179	10110011	211	11010011	243	11110011
148	10010100	180	10110100	212	11010100	244	11110100
149	10010101	181	10110101	213	11010101	245	11110101
150	10010110	182	10110110	214	11010110	246	11110110
151	10010111	183	10110111	215	11010111	247	11110111
152	10011000	184	10111000	216	11011000	248	11111000
153	10011001	185	10111001	217	11011001	249	11111001
154	10011010	186	10111010	218	11011010	250	11111010
155	10011011	187	10111011	219	11011011	251	11111011
156	10011100	188	10111100	220	11011100	252	11111100
157	10011101	189	10111101	221	11011101	253	11111101
158	10011110	190	10111110	222	11011110	254	11111110
159	10011111	191	10111111	223	11011111	255	11111111

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